File Filosophy

NICHOLSON FILE COMPANY • PROVIDENCE, R. I., U. S. A.

File Filosophy

(EIGHTEENTH EDITION—FIRST PRINTING)

being a brief account of the History, Manufacture, Variety and Uses of files in general.

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and

How to Get the Most Out of Files

Contents

Foreword

Since leadership, in any field, business or profession, brings to its possessor a measure of distinction and honor, it also imposes the responsibilities of helper and counselor.

It is fitting, therefore, that the Nicholson File Company—largest, one of the oldest, and probably the most widely known file manufacturer in the world—should dedicate to the tool-using public a book of this nature.

In its preparation we have gone back through the years—recounting those principles which time has proved sound in the manufacture of a product so highly important to the progress of thousands of industrial shops and to the livelihood of millions of individuals.

Much of the text itself is based on a treatise on files and their proper selection and use, written in 1878 by the founder of this Company, Mr. William T Nicholson. This treatise, in abbreviated form under the title of "File Filosophy," went through seventeen editions and repeated printings. It became universally accepted as an authority in its line.

File users have employed it as a practical guide in the art of filing. Mechanical experts and technical students have used it as a foundation for articles in the machinist and industrial press, and for talks to the men in the workshops and classrooms. It has even been supplied to other file manufacturers, and extracts have been used by them in their catalogs and other publications. It has been circulated gratis throughout the world. The numerous editions of "File Filosophy" have been due both to heavy popular demand and to a diligent endeavor to keep it up to date to cover changes in and additions to file designs; improvements in methods and operations; and new developments in materials and products.

"File Filosophy" now comes to you in more complete and elaborate form than ever before. Not only does it retain the fundamental discourses on general file designs, application and care embodied in preceding editions; but to it has been added much of the contents of a supplemental and more recent Nicholson book, "A File for Every Purpose." With modern industrial and machine-shop production calling more and more for specialization—in tools as well as in workers—*the right file for the job* has become increasingly important. Consequently, considerable thought and space have been devoted to special-purpose files—in the development of which Nicholson leadership has been typically conspicuous.

"File Filosophy" comes to you also with the sincere hope that it will be of interest and service to you as a file-using layman, mechanic, machinist, repairman, farmer, instructor, student, mechanical "trainee," or as one connected with the management or operation of any shop, plant or industry in which files are used.

WILLIAM T. NICHOLSON
Founder (1864) and President to 1893

SAMUEL M. NICHOLSON
President 1893-1939

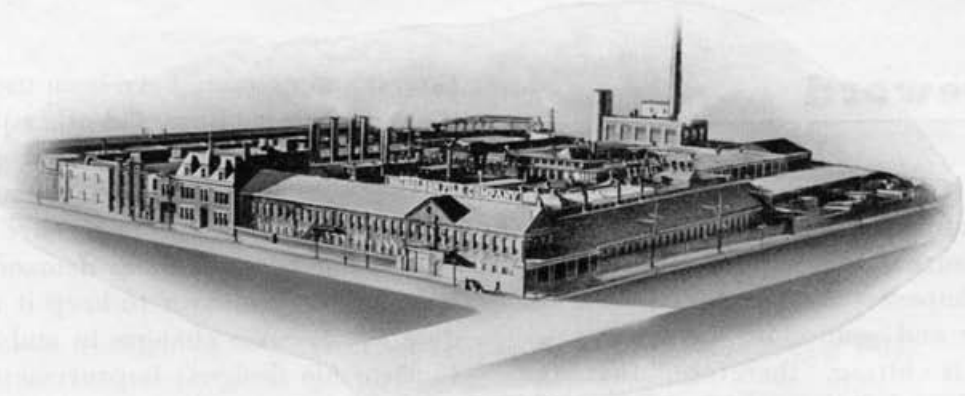
PAUL C. NICHOLSON
President 1939-1952

PAUL C. NICHOLSON, JR.
President 1952-

Paul C. Nicholson, Jr.

PRESIDENT

NICHOLSON FILE COMPANY *Providence, R.*



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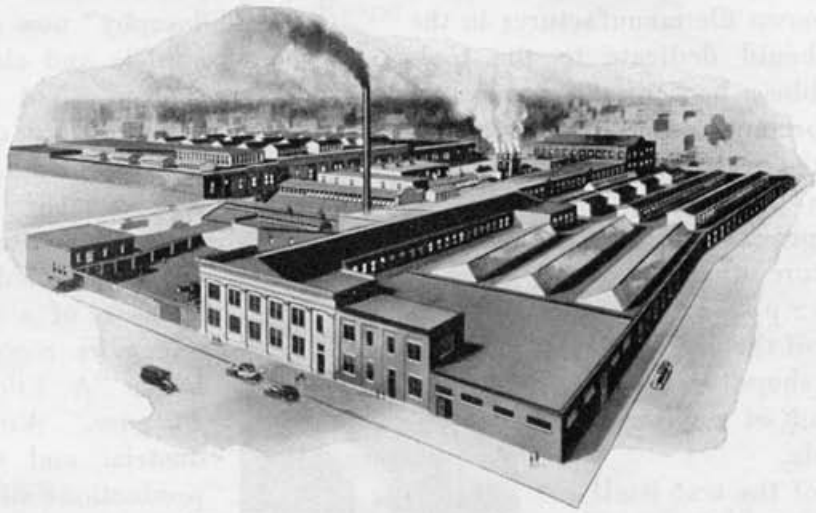

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King Saul Knew about Files

A bit of file history

The file is one of the oldest tools known to history It is recorded that as early as the reign of King Saul (I Samuel XIII:21), about the year 1090 B.C., "they had a file for the mattocks, and for the coulters, and for the forks, and for the axes, and to sharpen the goads."

The first files from which the modern tool has evolved may date back to prehistoric times, where we find primitive man shaping out his stone hatchet by abrading it with a flat piece of granite or of some harder stone — patiently filing away until his implement had attained the desired shape.

From the time of the first file, down through the ages, we find records of the development and evolution of the file — crude, hand-made affairs; no two alike and no standard as to shapes, grade of teeth or weight. The serrated edge of their chipped flint may have been used as a saw and the sides to smooth rough surfaces, whereby the flint became a combination of knife, saw and file. The early files were formed somewhat like a broad saw, the toothing being coarse, and running at right angles across the blade.

In the cemetery at Hallstadt, in Upper Austria, files of this character had been found, several being bronze and one of iron. They would have been used about 2000 years ago. Homer represents Vulcan making, by means of a hammer and a file, the wire for the net in which Mars and Venus were entangled. The earliest iron files were used by the Romans. They were made of a very mild steel, the largest being half an inch wide and three-tenths of an inch thick, cut on one side only

MACHINE-CUT FILES

About the year 1490 A.D., we find the first known *attempt* to cut files by machine, an invention of Leonardo da Vinci, famed for his sculpture, paintings and music — and also famed as a scientist, engineer and mechanician (although not realized by many who think of him only in connection with the "Last Supper" or the "Mona Lisa").

The first machine which actually cut files was probably that made by

Chopitel, a Frenchman, in 1750. Further machines, numbering a dozen, were invented between the years 1756 and 1862, mainly by Frenchmen.

We are told that a water-driven machine for cutting files was in use about 1765 in Sheffield, England. It was stated that this machine would make as many files in a given time as fifty men cutters, but it was destroyed by its inventor in a fit of bad temper. At that period, grinding was unknown for the smoothing of the surface of the file blanks, which was done with a hammer, and great skill was required to produce a surface suitable to receive the cutting.

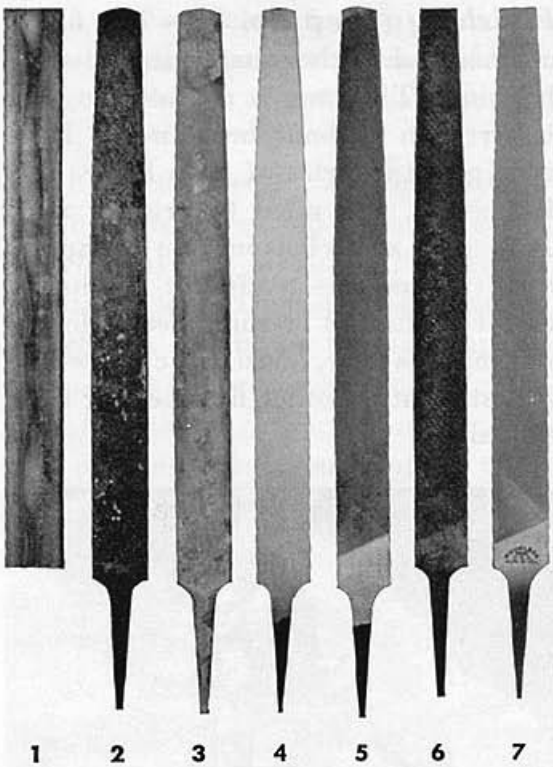
Being made from mild material, the blanks did not require annealing; and in order to procure a hardened surface, various secret preparations were used which served to carburize the file teeth and make them hard enough to abrade other materials.

When higher carbon material came into use, the annealing furnace was developed. One of the early methods of annealing was described by M. Jars as being in use in Sheffield and Newcastle. It was the practice to use cement steel and the blanks were annealed by coke. Theophilus Prysbeter, who lived in the latter part of the eleventh century, was one of the earliest writers on matters relating to the making of files, and he referred to these tools as being four-square, three-cornered and round, and consisting of pure steel. Other files were made from steel with a center of soft iron. The writer stated that the incisions to form the teeth were made by means of a hammer which was sharp at both ends.

The first American machine was made in 1836 and the first English machine (by Nasmyth) in 1840. Various further attempts to cut files by machinery were made. But it was the inventive genius of such men as Bernot, Nicholson, Whipple and Weed which brought forth machines capable of producing better files than could be made by hand, and of a uniformity which made possible the standardization of the various kinds and cuts of files.

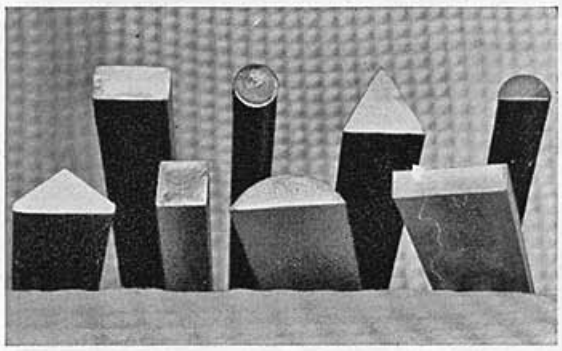
How a Quality File Is Born

Important Steps in Making Files



The making of files which are both high in lasting qualities and correct in designs for the various kinds of materials, products, finishes and working conditions for which they are intended is an industrial *science*. So varied are these combinations of filing factors that more than 3000 kinds, sizes and cuts of files are required to do an efficient job under all of them.

Expert file manufacture goes far beyond the factory walls. It involves the study of file steels, file designs and



file performance. This study extends to the metallurgical laboratory — to the steel mills — to industrial plants where files are in constant or diversified use — to the manufacturer's own proving shops.

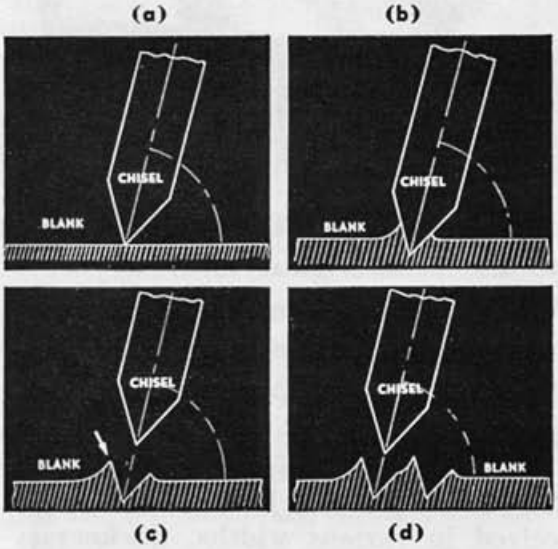
Steel (Step No. 1)—File steel is received in various widths, thicknesses and cross-sections (rectangular, square, triangular, round, half-round, etc.); is cut to the proper length for the finished product.

Rough Shaping (Step No. 2)—The blank is heated and forged. With trip-hammers and rollers both the tang and the point are properly shaped.

Annealing (Step No. 3)—The forged blank is heated to an elevated temperature and cooled slowly under closely controlled conditions to soften the steel for teeth cutting and to make the internal structure uniform.

Final Shaping (Step No. 4)—The annealed blanks are either ground or milled to produce the finished shape. This is followed by drawfiling, which produces the perfectly true flat or curved surface necessary for the uniform formation of the teeth.

Forming of Teeth (Step No. 5)—The teeth are formed by a rapidly reciprocating chisel that strikes successive blows on the file blank as it moves past the chisel. The hardened chisel cuts into the soft blank, displacing and raising the steel into the desired tooth structure. The single cut type of file has a single series of teeth. Double cut files have two series of diagonal teeth. The first of its cuts is called the overcut, the second the upcut.



CUTTING A FILE TOOTH. (a) Chisel about to enter surface of file blank. (b) Chisel has finished stroke, displacing—but not removing—a portion of metal and raising it above the surface. (c) Chisel, withdrawn, leaves a perfectly formed single cut file tooth, and is poised for the next powerful stroke. (d) Like this, tooth after tooth is formed with incredible precision—hundreds per file, *billions* in the making of millions of Nicholson Files!

Hardening (Step No. 6)—Having been forged, annealed, ground or milled, and cut, the files are heated in a molten lead bath to a closely controlled high temperature. This is followed by immersing the heated file in a quenching solution. This combination of heating and cooling under carefully controlled conditions brings the file to the maximum hardness to the very top of the cutting edges.

Finishing (Step No. 7)—The file is cleaned and further sharpened by sandblasting. The tang is reheated to give it strength without brittleness. It is then given a series of tests by trained inspectors, and oiled to prevent rust. It is now a Nicholson File Company quality product—ready for the hands of the industrial or shop mechanic, repairman, farmer, householder, mechanical student, or other file-needing individual.

A File for Every Purpose

To illustrate and describe the multiplicity of kinds, cuts and sizes of Nicholson Files would "fill a book"—and a large one at that. It is sufficient for the purpose of this one to confine illustration and descriptives to a somewhat general classification of kinds, with the assumption that most of them come in a range of cuts (coarsenesses) and sizes.

Files and Rasps have three distinguishing features: (1) Their *length,* which is always measured exclusive of the tang. (2) Their *kind* (or name), which has reference to the shape or style. (3) Their *cut,* which has reference to both the character and the relative degrees of coarseness of the teeth.

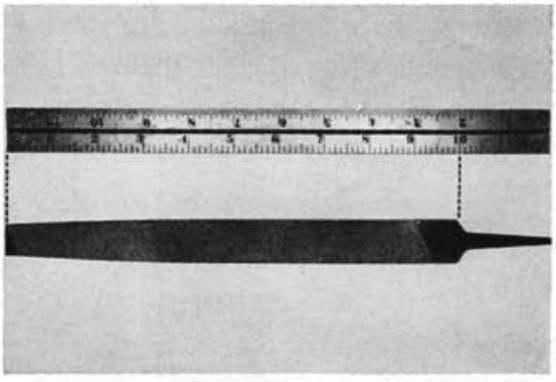
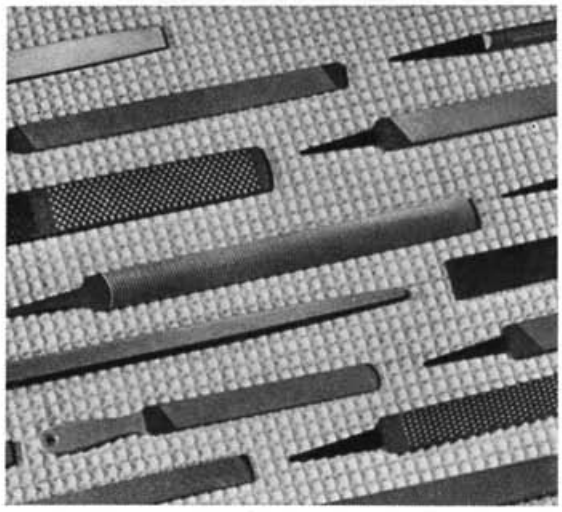


Fig. 1

Length. The length (Fig. 1) of the file is the distance between its heel (or part of the file where the tang begins) and the point (or end opposite). The tang (or portion of the file prepared for the reception of the handle) is never included in the length. In general, the length of files bears no fixed proportion to either their width or their thickness, even though the files be of the same kind.



Kind. By kind we mean the various shapes or styles of files, as distinguished by such technical names as Flat, Mill, Half Round, etc. These are divided, from the form of their cross-sections (Fig. 2), into three general geometrical classes: Quadrangular, Circular and Triangular. From them are derived, further, odd and irregular forms or cross-sections which are classified as Miscellaneous. *(As a file increases in length it grows in cross-section size.)*

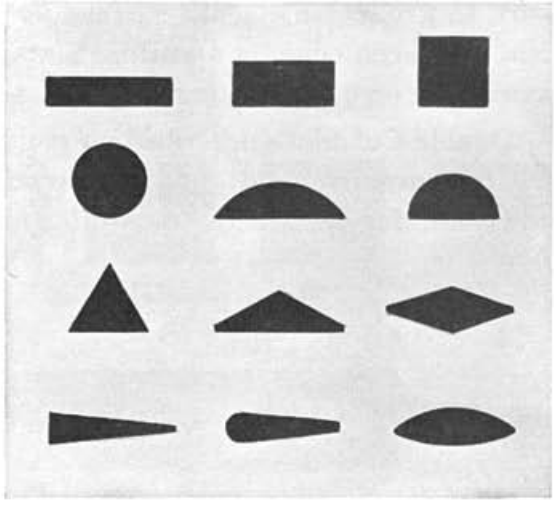


Fig. 2

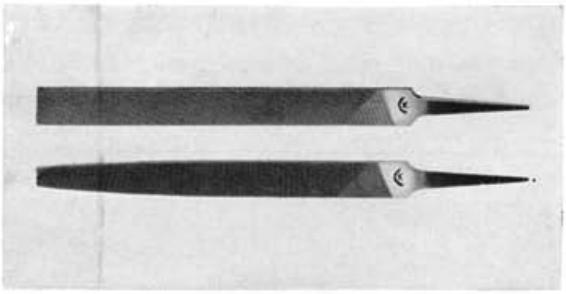


Fig. 3 (*Top—Blunt; bottom—Taper*)

These sections, in turn, are subdivided, according to their general contour or outline, into Taper and Blunt (Fig. 3)

Taper designates a file, the point of which is more or less reduced in size (either in width or thickness, or both) by a gradually narrowing section extending from one-half to one-third the length of the file, from the point.

Blunt designates a file that preserves its sectional size throughout, from point to tang.

Cut. The cut of files is divided, with reference to the *character* of the teeth, into Single, Double, Rasp and Curved (Fig. 4); and with reference to the *coarseness* of the teeth, into Coarse, Bastard, Second and Smooth Cuts.

Single Cut files (described on page 8) are usually used with a light pressure to produce a smooth surface finish, or a keen edge on a knife, shears, saw-tooth or other cutting implement.

Double Cut files (described on page 8) are usually used, under heavier pressure, for fast metal removal and where a rougher finish is permissible.

The Rasp Cut is a series of individual teeth produced by a sharp, narrow, punch-like cutting chisel. It is an extremely rough cut and is used principally on wood, leather, hoofs, aluminum, lead, and similarly soft substances for fast removal of material.

For unusual types of files, such as used on the flat surface of aluminum and steel sheets, a special Curved Tooth (single) is used.

Regarding coarseness, it is obvious that Coarse and Bastard Cuts are used on the heavier classes of work; the Second and Smooth Cuts for finishing or more exacting work.

On the following pages are some of the more widely used general-purpose files, together with cross-section views, the cuts they have, and the ranges of actual coarseness (exampled in Bastard cuts)

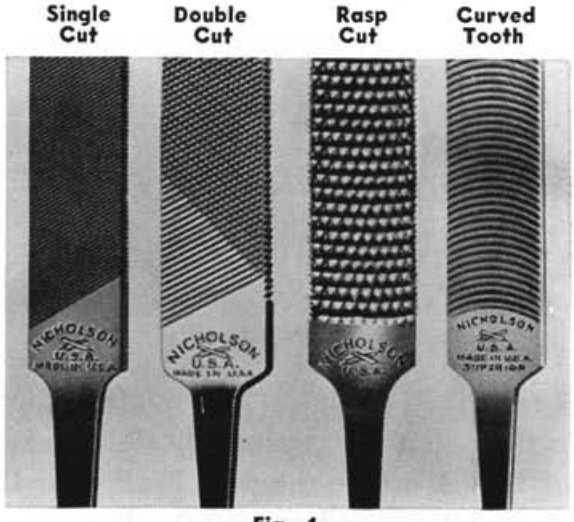


Fig. 4

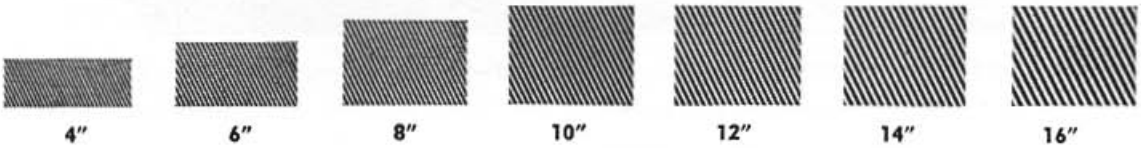
Mill and Other Types of Saw Files

Mill Files are so named because they are widely used for sharpening mill or circular saws. These files are also useful for sharpening large crosscut saws and mowing-machine knives; for lathe work, drawfiling; for working on compositions of brass and bronze; and for smooth-finish filing in general.

Mill Files are single cut and are tapered slightly in width for about a third of their length; 12″, 14″ and 16″ files are also tapered in thickness. Usually made with two square edges, with cuts thereon as well as on sides. Also made with one and two round edges—to maintain rounded gullets on crosscut saws. The Mill Blunt is likewise used for crosscut saws (and often for bucksaws) as well as for general filing.

The following illustration shows a typical range of coarsenesses of Tapered and Blunt Mill Files. These also apply approximately to the triangular and other shapes of Saw Files.

COARSENESS RANGE of a typical Mill Bastard File



MILL FILE (Tapered) with square edges. Also made with one or two round edges for filing the gullets between saw teeth.

Mill and Other Types of Saw Files

SPECIAL CROSSCUT FILE (with square edges) is used on both raker and cutter teeth of crosscut saws. Has orange-colored tang for easy identification.

TRIANGULAR SAW FILES are made for filing all types of saws with teeth of 60° angle. Taper, Slim Taper (illustrated), Extra Slim Taper, Double Extra Slim Taper.

ROUND CHAIN SAW FILE NO. 84 for round-hooded type chain saw teeth has uniform spiral cut of special shearing angle for sharpening and smoothing at same time.

FLAT CHAIN SAW FILE (with rounded edges) is used for filing plain cutter-and-raker type chain saw teeth.

LOZENGE CHAIN SAW FILE (with diamond-shaped cross-section) is used for filing square-hooded type chain saw teeth.

CANTSAW FILE is used for sharpening saws with less than 60° angle teeth—for many types of circulars and also for crosscuts with "M" teeth.

GREAT AMERICAN CROSSCUT FILE is used for sharpening a great variety of crosscut saws. Rounded back is used to deepen gullets of saw teeth; sides for filing teeth themselves.

WEB SAW FILE is for filing pulpwood or web saws—especially those having cutting teeth of less than 60° angle; also for filing each tooth bevel separately.

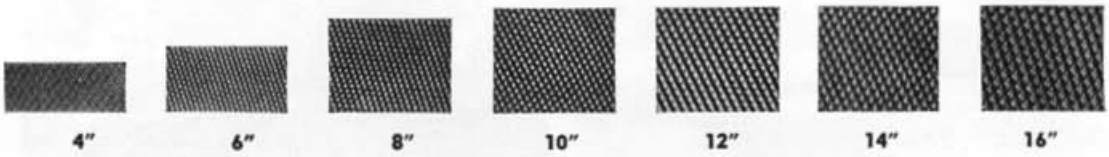
Machinists' Files

Machinists' Files, as name indicates, are widely used by machinists and repair shops; automobile, truck, tractor and other machinery manufacturers; ship, aircraft, engine and ordnance builders—in short, throughout industry wherever metal must be removed rapidly and finish is of secondary importance. They include Flat, Hand, Round, Half Round, Square, Pillar, Three Square, Warding, Knife and a number of less commonly known kinds. With certain exceptions in Round and Half Round, all Machinists' Files are double cut.

The first of the following illustrations shows a typical range of coarsenesses of Flat and Hand Files.

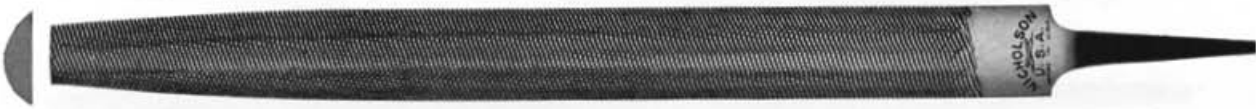
Machinists' Files

COARSENESS RANGE of a typical Machinists' Flat Bastard File



FLAT FILE is of rectangular cross-section, slightly tapered toward the point in both width and thickness, and is cut on both edges and sides. Widely used.

HAND FILE is similar to Flat File but is parallel in width and tapers in thickness only. One edge is "safe" (uncut) Frequently preferred by machinists for finishing flat surfaces.



HALF ROUND FILE has one rounded side (back) and one flat side. Flat side is always double cut; rounded is double cut with exception of all Smooth and 4" and 6" Second Cut, which are single cut. Half Round Files taper toward the point in both width and thickness.

ROUND FILES are made in tapered shape and are used generally to file circular openings or curved surfaces.

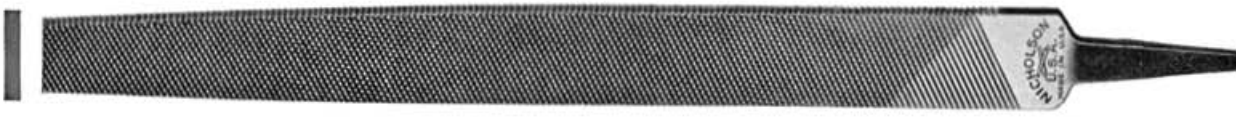
SQUARE FILE is used principally for filing slots, keyways, and also for general surface filing. In the larger sizes the Square File is sometimes preferred to the Flat File because of its heavier cross-section and its four filing sides.

PILLAR FILE has a rectangular cross-section. It is like the Hand File, but thicker and not so wide; and has one "safe" (uncut) edge. Used principally by machinists for filing slots and keyways.

THREE SQUARE FILE is double cut (with edges left sharp and cut), whereas "Tapers" (see Saw Files) are single cut. Used by machinists for filing acute internal angles, for clearing out square corners, and repairing damaged screw threads.

WARDING FILE is rectangular in section, tapers to narrow point as to width, and is used principally by locksmiths for filing notches in keys and locks. Also suited for general narrow-space filing where other files will not do.

KNIFE FILE is of knife-blade section and is used principally by tool and die makers on work having acute angles.



WOOD FILES (distinguished from Wood *Rasps*) are made in the same sections as Flat and Half Round Files, but with coarser teeth which fit them especially for use on wood.

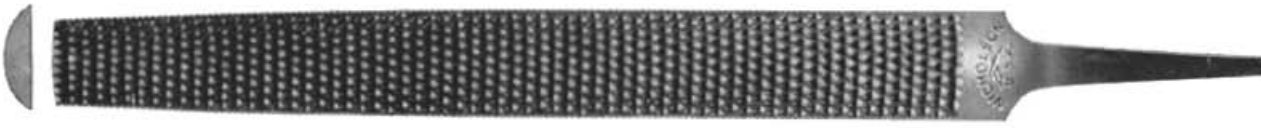
FLAT MACHINIST'S G. P. (General Purpose) FILE—another new file development exclusively by Nicholson—has single cut teeth divided by angular serrations which produce short cutting edges. This helps break up filings, speed stock removal, and still leave a smooth finish. Designed for general purpose filing on various materials including aluminum, bronze, cast iron, malleable iron, mild steels and annealed tool steels.

Rasps

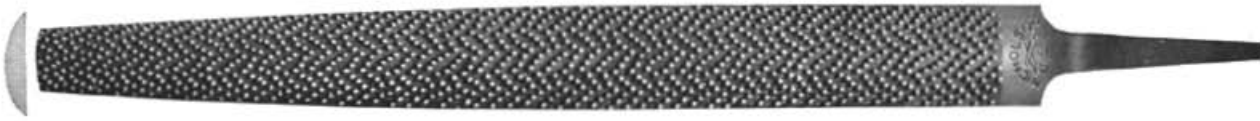
The Rasp cut differs from both the Single and Double cuts of files in the respect that the teeth are individually formed and disconnected from each other (see further description on page 10) In the Half Round Wood Rasps the curved side is similar to that of the Half Round File, but in the Cabinet, the Pattern Makers and Last Makers Cabinet Rasps, the radius is larger. Rasps are also made in Flat and Round shapes.

Rasps have long been an important tool of cabinetmakers, wheelwrights, shoemakers, horseshoers, plumbers and others working on relatively soft substances requiring the fast removal of material.

WOOD RASPS are used by woodworkers, wheelwrights and plumbers. Made in Flat, Half Round and Round shapes.

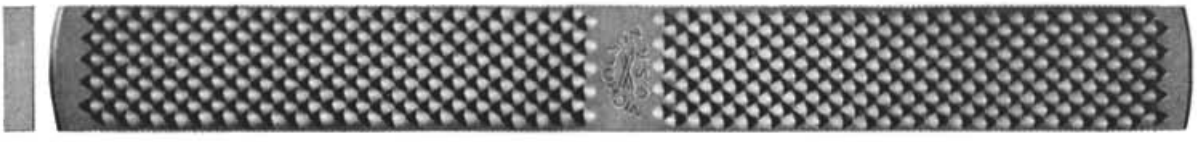


CABINET RASPS, used by cabinetmakers and woodworkers, are available in Cabinet and Round shapes, and in the style of cut as Wood Rasps but with relatively smaller degrees of coarseness.

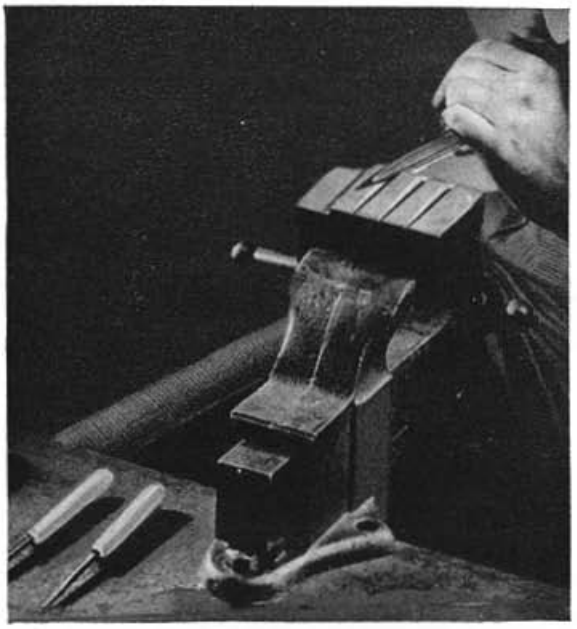


PATTERN MAKERS AND LAST MAKERS CABINET RASPS are used where a smooth wood finish is required. Cabinet shape, with Pattern Makers having cut edges and Last Makers uncut edges.

4-IN-HAND RASP-FILE (*formerly Shoe Rasp*) is made in Half Round cross-section (without the usual sharp edge) Half of each surface is *file* cut and half *rasp* cut. A fine all-around tool for home craftsmen, boat builders, etc., as well as for shoemakers and shoe repairers.



HORSE RASPS come in Plain (illustrated) and Tanged types and Flat section. Plain Horse Rasps are double ended. All have rasp teeth on one side and file teeth on the other.



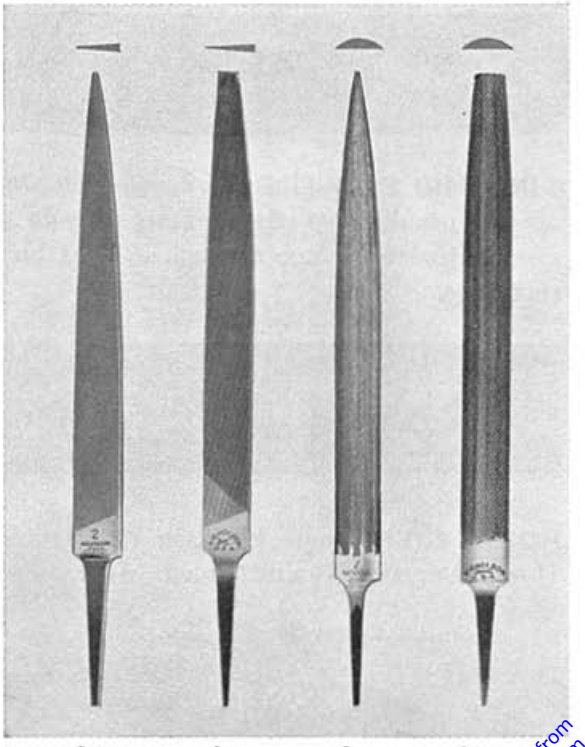
Swiss Pattern Files

The so-called "Swiss Pattern" Files constitute a vast field of their own. They are used by tool and die makers, jewelers, model makers, delicate instrument parts finishers, home craftsmen. In short, every one who does superfine precision filing will have many uses for Swiss Pattern Files.

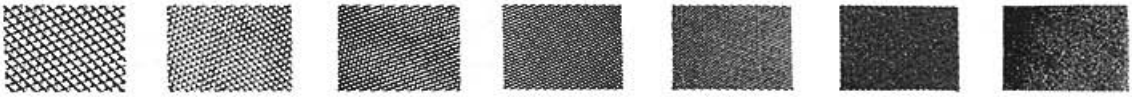
Swiss Pattern Files are made to more exacting measurements than the conventional American Pattern Files. Although some cross-sections of both types are similar, the shapes differ. The points of Swiss Pattern Files are smaller, and the tapered files have longer tapers. They are also made in much finer cuts, which vary from No. 00, the coarsest, to No. 6, the finest (see coarseness range on next page).

Swiss Pattern Files are primarily finishing tools — used for removing burrs left over from previous finishing operations; truing up narrow grooves, notches and keyways; rounding out slots, and cleaning out corners; smoothing small parts; doing the final finishing on all sorts of delicate and intricate pieces.

TWO TYPICAL COMPARISONS of Swiss (Sw.) vs. American (Am.) Pattern Files—in Knife and Half Round shapes.



COARSENESS RANGE of a typical Swiss Pattern Hand File



SWISS PATTERN HALF ROUND FILE. Double cut on both flat and half round sides.

SWISS PATTERN SQUARE FILE. Double cut on all four sides. Narrower and longer tapered than comparative American Pattern File.

SWISS PATTERN ROUND FILE (Tapered). Double cut. Narrower and longer tapered than conventional American Pattern Round File. Also made in Blunt shape.

SWISS PATTERN PILLAR NARROW FILE. Double cut on sides; edges "safe." Also made in regular and Extra Narrow pillar cross-sections.

SWISS PATTERN KNIFE FILE. Double cut on sides; single cut on edges. Tapers to a point in both width and thickness, with knife-shaped cross-section at about 10° angle. (See opposite page for comparison with American pattern.)

SWISS PATTERN THREE SQUARE FILE. Double cut on sides; single cut on edges. Narrower and longer tapered than comparable American Pattern sizes. Also Blunt shape—used mainly for filing metal saws and sometimes called Metal Saw File.

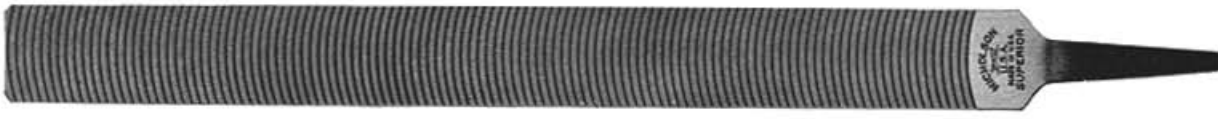
Swiss Pattern Files come in upwards of a hundred additional shapes — many of them multiplied by a range of sizes—and, in addition to the more commonly named ones shown above, are variously classified or grouped as: Square and Round Handle Needle, Die Sinkers, Parallel and Bench Filing Machine, Broach, Corrugating, Joint, Pippin, Slitting, Crossing, Screw Head, Equaling, Warding, Barrette Files, and Silversmiths' Rifflers.

Curved Tooth Files

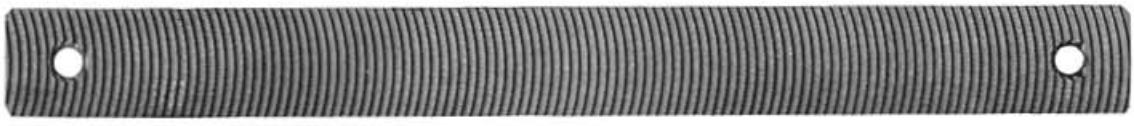
Curved Tooth Files cover a distinct filing field and have a considerable range of shape and structural characteristics. They are widely used in the automobile manufacturing and repairing industries for work on aluminum and sheet steel (on flat or curved surfaces). They are also used on such soft metals as brass and babbitt, and often on iron and steel. Because of their curved teeth they readily clear themselves of chips and have the correct rake for speed and economy.

Regular Curved Tooth Files are made in both Rigid and Flexible forms — the Rigid, either tanged for the conventional handle or plain (with hole at each end) for special holders; Flexible, plain only Standard, Fine and Smooth cuts; in parallel Flat, Square, Pillar, Pillar Narrow, Half Round, Shell and Moulding types.

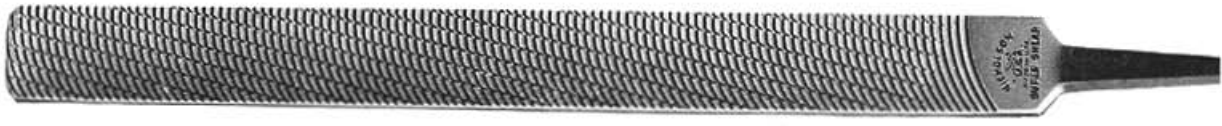
A special Curved Tooth File is the Super-Shear. Exclusive with Nicholson—its teeth, divided by angular longitudinal serrations, are cut in an "off center" arc. This gives them virtually a right angle and wide gullet toward one edge—for fast cutting. It also gives a longer, shearing angle and narrower gullet toward other edge—for smoothing. Practically two files in one!



FLAT TANGED CURVED TOOTH FILE



PLAIN FLEXIBLE CURVED TOOTH FILE



SUPER-SHEAR — SPECIAL FLAT TANGED CURVED TOOTH FILE

CURVED TOOTH FILE HOLDERS FOR PLAIN TYPES WITH HOLED ENDS

- *Left* — Adjustable Flexible File Holder
- *Right*—Half Circle File and Handle

File Terminology

Back. The convex side of Half Round, Cabinet, Pitsaw and other files of similar cross-section.

Bastard Cut. File coarseness between "Coarse" and "Second Cut."

Blank. A file in any process of manufacture before being cut.

Blunt. Used to describe a file with parallel edges and sides; *i.e.*, which preserves its sectional size throughout from point to tang.

Coarse Cut. Coarsest of all cuts.

Curved Cut. File teeth which are made in curved contour across the file blank.

Cut. The character of a file's teeth with respect to *coarseness* (Coarse, Bastard, Second, Smooth) or their *type* (single, double, rasp, curved, special).

Dead Smooth Cut. The finest of the standard cuts of regular files.

Double Cut. A file tooth arrangement formed by two series of cuts—the overcut, followed, at an angle, by the upcut.

Filing Block. A piece of hard, close-grained wood having grooves of varying sizes upon one or more of its sides. Used for holding small rods, pins, etc., in the jaws of the vise while being filed. Also a block of zinc, copper or other fairly soft metal as one of a pair of "protectors" placed between the vise jaws to prevent work becoming damaged while being held for filing.

Float. Sometimes used to refer to the coarser grades of single-cut files when cut for very soft metals (like lead) or for wood.

Overcut. The first series of teeth put on a double-cut file.

Point. The front end of a file.

Rasp Cut. A file tooth arrangement under which teeth are individually formed, one by one, by means of a narrow, punch-like chisel.

Re-cut. A worn-out file which has been re-cut and re-hardened after annealing ("softening") and grinding off the old teeth. (Similar to "regrooving" as applied to automobile tires.)

Safe Edge (or Side). Used to denote that a file has one or more of its edges or sides smooth or uncut, so that it may be presented to the work without injury to that portion or surface which does not require filing.

Scraping. As applied to machine shops, the process of removing an exceedingly small portion of the wearing surfaces of machinery by means of scrapers, in order to bring such surfaces to a precision fit or finish not attainable by ordinary filing means.

Second Cut. File coarseness between "Bastard" and "Smooth."

Section (or Cross-section). The end view of a file if cut off squarely at the greatest width and thickness from its tang.

Set. To blunt the sharp edges or corners of file blanks before and after the overcut is made, in order to prevent weakness and breakage of the teeth along such edges or corners when file is put to use.

Single Cut. A file tooth arrangement formed by a single series of cuts.

Smooth Cut. A file cut of less coarseness than "Second Cut."

Tang. The narrowed portion of a file which engages the handle.

Taper. Used to denote the shape of a file, as distinguished from the Blunt. Custom has also established it as a short name for the Triangular Handsaw File. Graded variations are Slim Taper, Extra Slim Taper and Double Extra Slim Taper.

Upcut. The series of teeth superimposed on the overcut, and at an angle to it, on a double-cut file.

FILE NAMES

Aluminum "A." A special-cut file for work on aluminum stock or castings.

Auger Bit. A file with double ends (each with different cut) for sharpening auger bits.

Brass. A file for use on brass and similar soft metals.

Broach. Jewelers' steel-wire files of many gauges.

Cabinet (File or Rasp). Used by cabinetmakers and woodworkers.

Contact. A file for dressing "make-and-break" points of electrical circuits (also called Tungsten).

Corrugating. A file made for corrugating the edges of barbers' shears and other edged tools.

Crosscut. A file for sharpening crosscut saws.

Curved Tooth. A file with milled curved teeth instead of straight-line cut teeth.

Die Cast. A file for use on aluminum or zinc castings.

Die Sinkers. Files, of various shapes, used by die makers.

Double Ender. A saw file cut from the points toward the middle—for filing from either end.

Foundry. A file used on castings formed from foundry molds.

G. P. Machinist's. A general-purpose file for use on a variety of metals of milder hardnesses.

Hand. A double-cut file with parallel edges and tapering thickness.

Handsaw. A triangular file (see Slim Taper) for sharpening handsaws.

Knife. A file whose cross-section resembles the blade of a knife—thick at one edge, thin or sharp at the other.

Lead Float. A single-cut file for use on lead, babbitt and other extra-soft metals.

Machine. Files used in filing machines.

Machinists'. Applied to various shapes of files, mostly double-cut, used in machine and repair shops.

Mill. A single-cut (tapered or blunt) file which acquired its name from its early use in filing mill or circular saws.

Needle. Files of many shapes, used by tool and die makers, and also by watch and clock makers.

Pillar. A parallel-edge file with rectangular cross-section of narrow width and extra thickness.

Pippin. A file with a cross-section resembling a pippin (apple) seed.

Pitsaw. A file used for sharpening pitsaws.

Plastic. Files, of various types, used in flash removal and other finishing work on molded plastic products.

Rifflers. Fine-point and vari-shaped files used by die sinkers and silversmiths.

Screw Head. A file for clearing out the slots in the heads of screws.

Shear Tooth. A coarse, long-angle, single-cut file.

Slim Taper. Triangular file, slenderer than the regular Taper, used mainly for handsaw sharpening. Also Extra Slim Taper and Double Extra Slim Taper.

Stainless Steel. A special-cut file for use on stainless and other extra-tough steels.

Super-Shear. A milled curve-tooth file with angular longitudinal serrations.

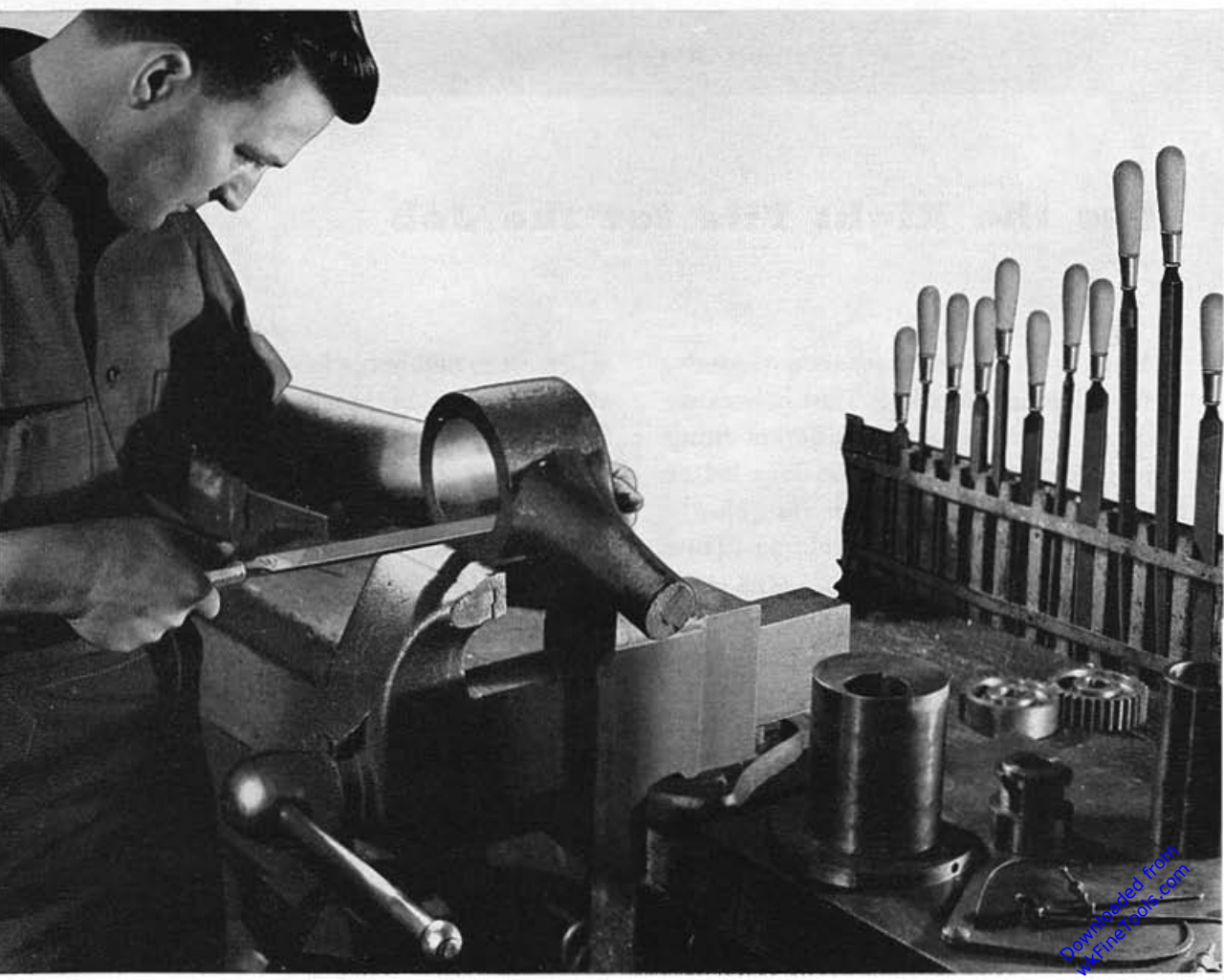
Swiss Pattern. A large series of files of various shapes and a range of cuts of their own, designed principally for precision work in the jewelry, die-making, silversmith, clock-making, watch-making and other industries.

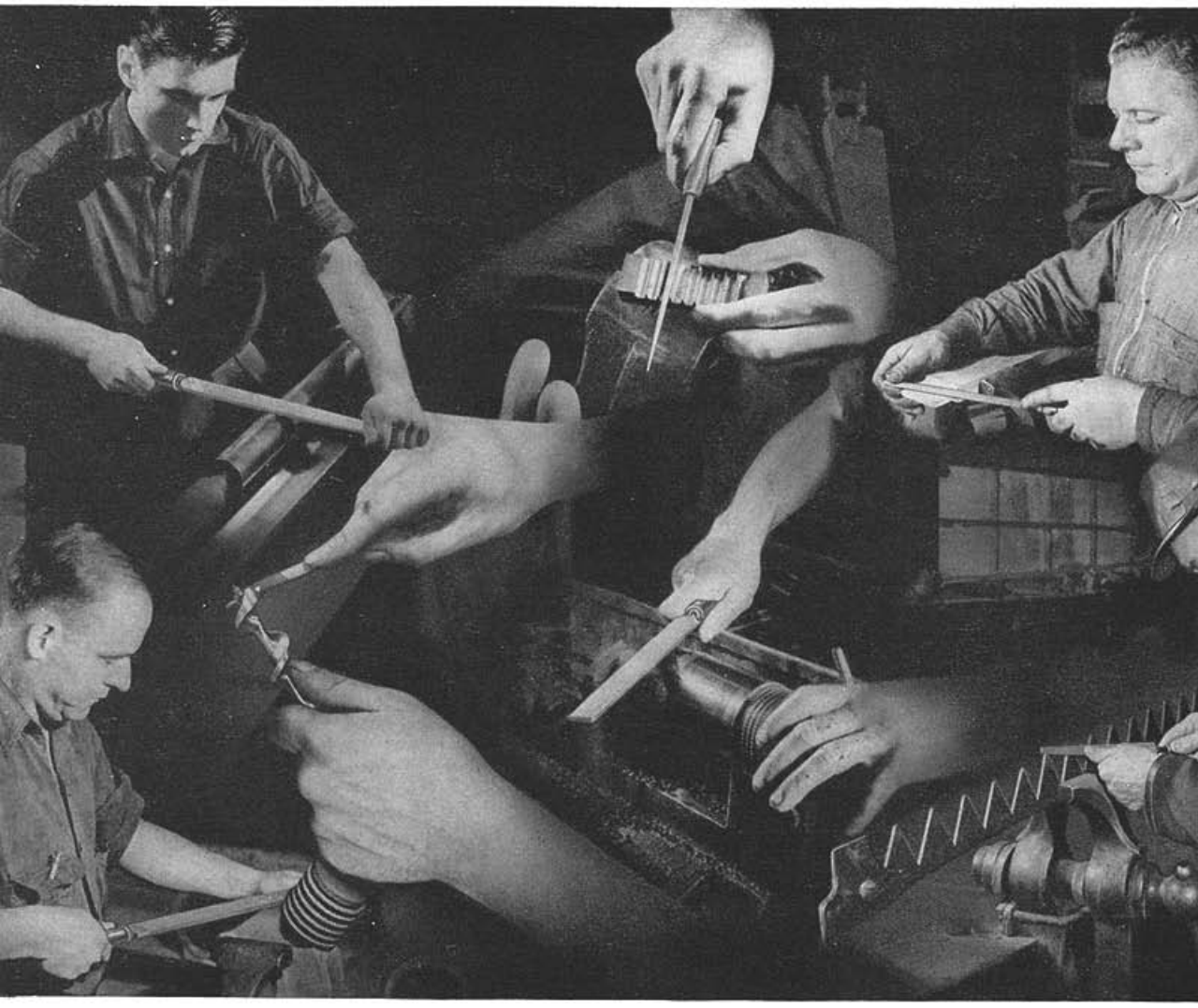
Taper. Used to denote the shape of a file as distinct from Blunt. Custom has also established it as a short name for the triangular Handsaw File.

Three Square. A file whose cross-section is triangular. Usually applied when such file is double-cut.

Warding. A file named after its original or most common use filing ward notches on keys and locks.

How to Get the Most Out of Files





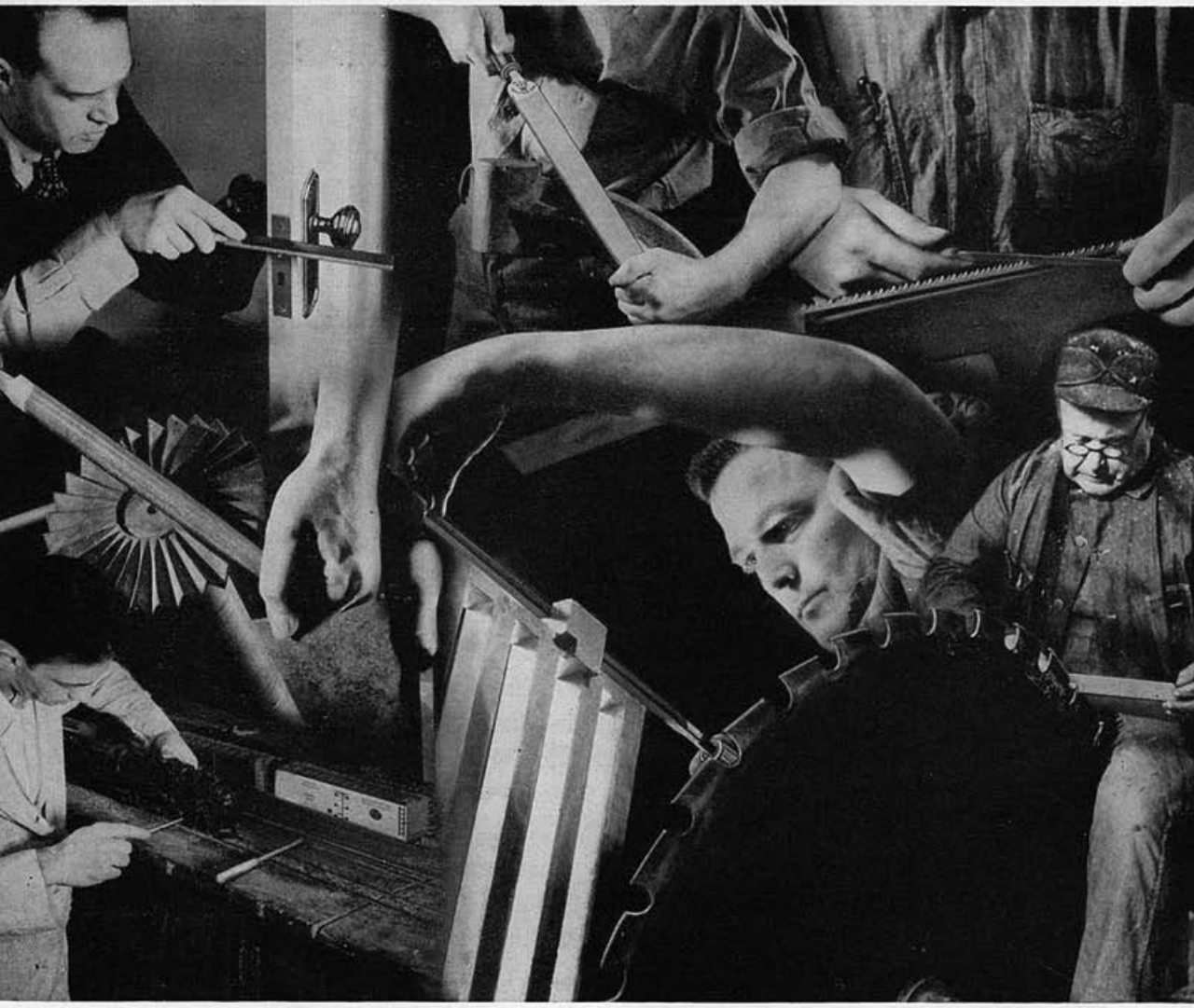
Use the Right File for the Job

Actually there are *thousands* of kinds, cuts and sizes of files. That is because there are thousands of different filing jobs, each of which can be done better by using *the right file for the job.*

Therein lies the first rule on "How to get the most out of files." The right file enables doing the job properly, whereas the wrong one does not — and often, in fact, ruins the work. The right file saves time, because it performs correctly, and usually faster, on the kind of metal or work for which it is designed. The right file permits a greater number of efficient filing strokes — per file and per file cost. Sum up all these advantages and they represent a *big* item of savings in a day's filing and production costs.

Many factors enter into the selection of *the right file for the job.* In general, it may be said that different files are required: (1) to file a flat or convex surface; (2) to file a curved or concave surface; (3) to file an edge; (4) to file a notch, a slot, or a square or round hole.

But these factors can immediately



become complicated by: (1) the kind of metal or other material to be filed; (2) the kind, shape and hardness of object or part to be filed; (3) the location, size and character of the surface, edge, notch, slot or hole to be filed; (4) the amount of metal to be removed and the practical time permitted for removing it; (5) the degree of smoothness or accuracy required.

All these conditions have a bearing on the kind, size and cut of file which will best attain a particular objective. Calculate the number of possible combinations of such conditions, and selecting exactly the right file for *any* combination thereof would seem to be a sizable task for any one person.

Experience is a good guide — but a slow teacher. But with the aid of the information in this book, no file user need ever be far off the track to *the right file for the job.* This, at any rate, is true as to the *kind* or type of file for the object and metal or other material to be filed. The filer's own survey of the conditions will help further to determine the right *size* and *cut* of file.

Use the Right Filing Method Too

Fig. 1 — Right

Fig. 1-a — Wrong

"The tool is but the extension of the hand," say the philosophers. Even though it be the right tool for the job, it can serve its purpose efficiently only through the power and *proper guidance* supplied by the hand.

The skill or aptitude of the mechanic is usually shown by the way he masters the fundamentals of his trade. Hammer, saw, chisel, plane, file — there is a right and a wrong way to use each. Furthermore, each calls for different "touches" according to the character of the work, the working conditions and the kind of results sought. The logic applies with particular aptness to files and how to get the most out of them.

Filing is an industrial art — in precision work especially Grip, stroke and pressure must vary to "fit the job" *and* the kind of file used. But all spring from such basic principles as are brought out in this discourse.

FILING ACTIONS

There are three elemental ways in which a file can be put to work:

(1) *Straight filing,* which consists of pushing the file lengthwise—straight ahead or slightly diagonally — across the work (since all files, with the exception of a few machine-operated files, are designed primarily to cut on the forward stroke).

(2) *Drawfiling* (page 28) which consists of grasping the file at each end and pushing and drawing it across the work.

(3) *Lathe filing* (see page 29) which consists of stroking the file against work revolved in a lathe.

All of these filing actions are discussed at greater length herein.

PLACE WORK AT PROPER HEIGHT FOR FILING

Most work to be filed is held in a vise (Fig. 1) For general filing, the vise should be about elbow height. If a great deal of heavy filing is to be done, it is well to have the work lower. If the work is of a fine or delicate nature, it should be raised near to the eye level.

For work which is apt to become damaged by pressure when held in a vise, it is well to provide a pair of "protectors"— pieces of zinc, copper, or other fairly soft metal for placing between the jaws and the work to be held (Fig. 2) For holding varying sizes of round pieces — such as small rods

Fig. 2

and pins — a block of hard, close-grained wood with a series of varying-size grooves is sometimes used where a lot of filing of such pieces is required.

GRASPING THE FILE

With files intended for operation with both hands, one of the most generally accepted ways of grasping the handle is to allow its end to fit into and bring up against the fleshy part of the palm below the joint of the little finger — with the thumb lying parallel along the top of the handle and the fingers pointing upward toward the operator's face.

The point of the file is usually grasped by the thumb and the first two fingers of the other hand. The hand may then be so held as to bring the

Fig. 3

thumb, as its ball presses upon the top of the file, in line with the handle when heavy strokes are required.

When a light stroke is wanted, and the pressure demanded becomes less, the thumb and fingers of the point-holding hand may change their direction until the thumb lies at right angle, or nearly so, with the length of the file — the positions changing more or less as may be needed to increase the downward pressure (see Fig. 1).

In holding the file with one hand, as in filing pins, dies and edged tools not held in a vise, the forefinger — instead of the thumb — is generally placed on top and as nearly as possible in the direction of its length (Fig. 3).

"CARRYING" THE FILE

The most natural movement of the hands and arms is to "carry" (stroke) the file across the work in curved lines. This tends toward a rocking motion and, consequently, a convex surface where a level surface is desired.

For the usual flat filing, the operator should aim to carry the file forward on an *almost* straight line — changing its course enough to prevent "grooving."

A very wrong method of carrying the file is shown on page 26 (Fig. 1-a) Too much pressure is evident; grip is too "desperate"; file isn't held level, motion is curved—"rocking"—and a rounded, instead of squared, surface is inevitable.

KEEP THE FILE CUTTING

One of the quickest ways to ruin a good file is to use too much pressure — or too little—on the forward stroke. Different materials, of course, require different touches; but, in general, just enough pressure should be applied to keep the file cutting at all times. If allowed to *slide* over the harder metals, the teeth of the file rapidly become dull; and if they are "overloaded" by too much pressure, they are likely to chip or clog.

On the reverse stroke it is best to lift the file clear off the work, except on very soft metals. Even then the pressure should be very light—never more than the weight of the file itself.

Drawfiling

Drawfiling consists of grasping the file firmly at each end and alternately pushing and pulling the file sidewise across the work. Since files are primarily made to cut on a longitudinal forward stroke, a file with a short-angle cut should never be used for drawfiling, because of the likelihood of scoring or scratching instead of shaving or shearing. When properly done, drawfiling produces a somewhat finer finish than "straight" filing.

Drawfiling is used extensively right in file factories themselves, in preparing file blanks for cutting. It assures a perfectly smooth, level surface and uniform file teeth. (See chapter on "How a File Is Born.")

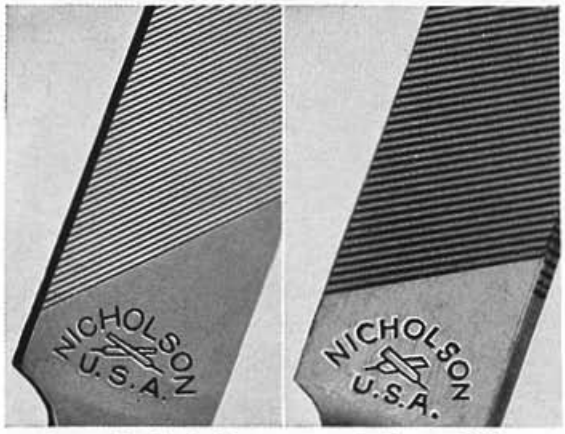
Ordinarily, a standard Mill Bastard File is used for drawfiling. But where

a considerable amount of stock is to be removed — as on the edge of a metal sheet or plate — a Flat or Hand File (double cut) will work faster. However, the double cut file usually leaves small ridges in the work and consequently does not produce a finished job where a smooth surface is required. In such cases the double cut may be used for the roughing down, then followed by the single cut (Mill) for the finishing.

Lathe Filing

In holding the file against work revolving in the lathe, it should not be held rigid or stationary but should be stroked constantly A slight gliding or lateral motion assists the file to clear itself of chips, and also avoids producing ridges or scores.

While the ordinary Mill File is normally capable of doing good lathe-filing work, there is a special Long Angle Lathe File with teeth cut at a much longer angle than those of the standard Mill File. This provides a much cleaner shearing, self-clearing file; eliminates drag or tear; overcomes "chatter"; reduces clogging. It is very fast-cutting; and the most delicate touch brings the work to a fine silken-smooth finish. "Safe" (uncut) edges on this file protect any shoulders of the work which are not to be filed. They also protect the "dog" which enables the lathe to revolve the work.



Long Angle Lathe Ordinary Mill

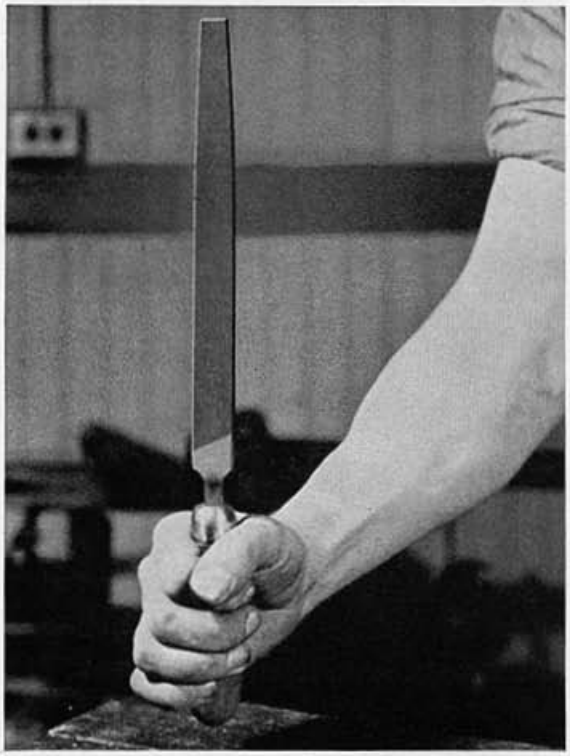
Lathe filing is most commonly employed for the purpose of fitting shafts. In general, the highest spindle speed should be used on such work; and where the amount of stock to be removed is considerable, the 12″ or 14″ Long Angle Lathe File is the preferable size. This type file is largely used in industrial plants to bring a shaft

down to a drive fit. For a running fit, for example, where a shaft is to run on a bearing, a Mill File will best provide the necessary smooth finish. Where a fine, highly polished finish is desired, a Swiss Pattern Hand or Pillar File in No. 4 or No. 6 cut may be used with very good results.

Many lathe filers make a practice of running a new file over a flat piece of cast iron before using it on lathe work, for the purpose of removing extreme sharpness from the top edges of the teeth. This is necessary, however, only on work requiring a very smooth finish.

In using the Long Angle Lathe File, care should be taken at shaft ends and shoulders, as this fast-cutting file may easily cut too deeply at such points. It is also important never to run the hand over work on a lathe, as the accumulated oil and moisture from the hand will sometimes so coat the surface of the work that it becomes difficult for the file to take hold again.

In lathe-filing work which does not have a cylindrical surface, but an oval, elliptical or irregularly rounded form, the finer or lighter cutting Swiss Pattern Files will be found most satisfactory They are made in a wide range of shapes, sizes and cuts, and will impart a smooth finish to any work filed in a lathe.



"Know Your Files and Get Ahead!"

You wouldn't drive a spike with a tack-hammer, shave with a bowie-knife, or cut cloth with a sheep shears. It is equally important to select *the right file for the job* (plus a good handle of proper size). Deep-biting double-cut Flat or Hand Files for fast metal removal; single-cut Mill Files for smooth finishing and edged-tool sharpening these are elementaries in the rule book.

As the job becomes more specific, selection of files becomes equally specific. For keyways, slots, and for narrow work and sharp angles, the mechanic who aims to get the most out of his files and filing skill selects Pillar, Square, Three Square or Warding Files; Knife Files for extra-narrow spaces. For the infinite angles, curves, holes and slots encountered in model making and die making, or for fine-instrument assembling and repairing, there is a multiplicity of shapes, sizes and cuts in small "precision" files commonly known as "Swiss Pattern."

Thus all files, in a measure of speaking, have a "special purpose" or reason for their existence in particular sizes, cuts, shapes or other characteristics. Under today's fast-moving industrial progress, production methods, machine-shop practices, and metal and alloy developments, there has been brought about a need for a distinct group of Special Purpose Files with which the modern mechanic will do well to become familiar. Their creation will be best understood through the various separate illustrations and descriptions which follow.

Special Purpose Files

Filing Rough Castings

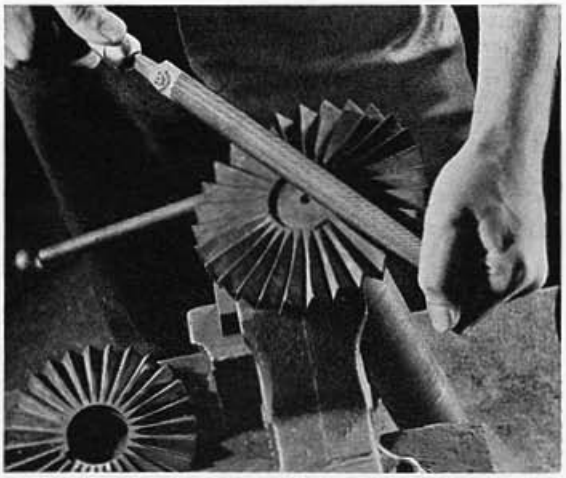
Snagging castings—removing fins, sprues and other projections — is very rough work and mighty tough on ordinary files. Their teeth are designed for sharp, fast cutting and therefore do not possess the ruggedness to withstand the shock when driven under pressure against hard projections or sharp edges. Filing of this sort engages only a few teeth at one time, thus putting a severe strain on each.

For such work, therefore, it is best to use a special Foundry File whose teeth are sturdier and have heavy-set edges — to resist shelling or breaking out. While not expected to possess the cutting speed of ordinary files, Foundry Files have much longer efficient life on the kind of filing for which they are designed. (Foundry Files are also widely used for filing sharp corners of dies.)

Filing Die Castings

Like foundry castings, die castings usually have sharp corners, webs, fins or flashings which are likely to damage the teeth of regular files. Furthermore, when die castings consist of magnesium, zinc, aluminum alloy or similar combinations of metal, they have a tendency to clog regular files.

Using the special Die Cast File — with its extra-strong teeth on corners and edges as well as sides — not only overcomes these disadvantages, but also serves for finishing the larger surfaces of die castings. These are usually held in one hand and filed with the other;

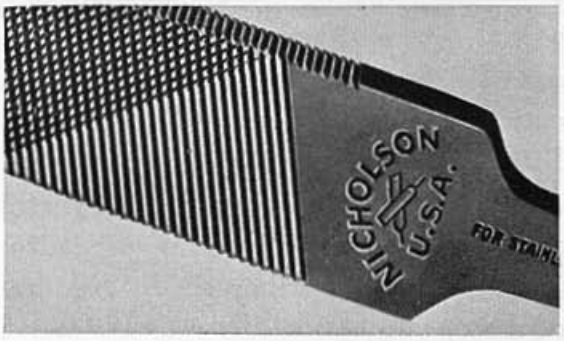


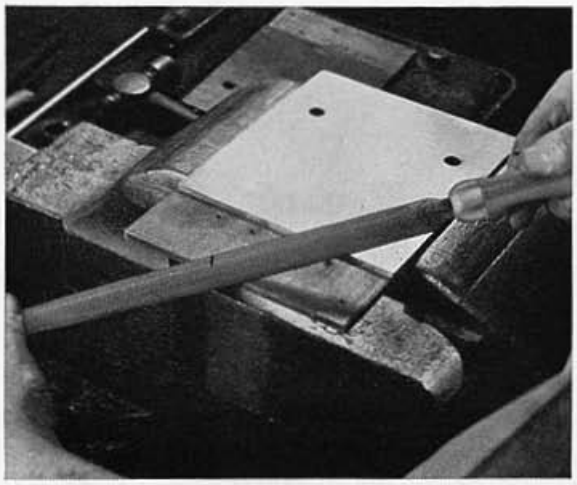
while larger castings are generally held in a vise, leaving both hands free for working the file.

Filing Stainless Steel

The tremendous increase in the use of stainless steel and similar alloy steels has created a new and distinct filing problem. The hard chromium and nickel content of these steels makes them extremely tough and dense. This causes them to have an abrasive action that tends to shorten the life of the general purpose file.

Research has overcome this problem with a special file for such steels. It is



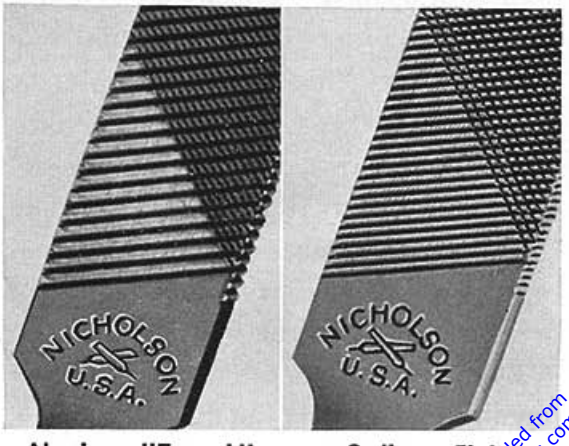


a file of exceptional wearing qualities. Properly used with a light pressure and a slow, steady stroke, this new file removes the metal rapidly, requires but little effort and leaves a good finish. Same shapes and sizes as in general purpose files.

Because aluminum is a soft, ductile and malleable metal, it is difficult to file with ordinary files because the file teeth soon become clogged—even under moderate pressure.

The filing of aluminum can be divided into three general classifications: (1) Filing the roughness from aluminum castings; (2) filing sheet and bar aluminum; (3) filing aluminum alloys. To cut aluminum rapidly and yet leave a good finish, the Aluminum "Type A" File is a recent file-manufacturing development. Its special tooth construction is very effective in eliminating clogging. The upcut is deep with an "open-throat"; the overcut fine, producing small scallops on the upcut which break up the filings, allow the file to clear itself, overcome chatter and prevent taking too large a bite.

By using this file with a shearing stroke toward the left, a good finish can easily be obtained. (Views below show the tooth construction of the Aluminum "Type A" File in comparison with regular Flat File.) Made in Flat and Half Round shapes.

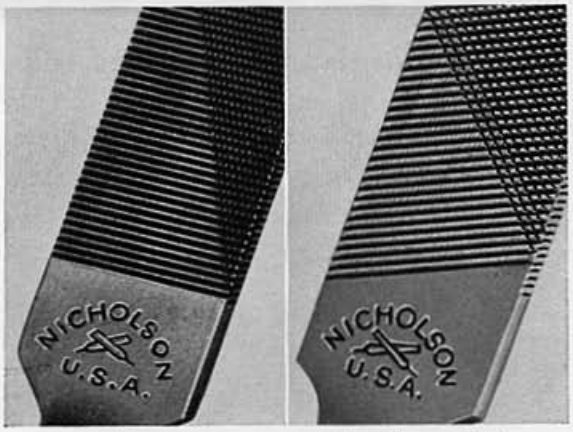


Aluminum "Type A" Ordinary Flat

Filing Brass

With a structure all its own, brass is a difficult metal to file. While softer than steel, brass is tough and ductile. These characteristics demand file teeth that are sturdy, very sharp, and cut at an angle that prevents "grooving" and running the file off the work. Still more important, the file must not clog.

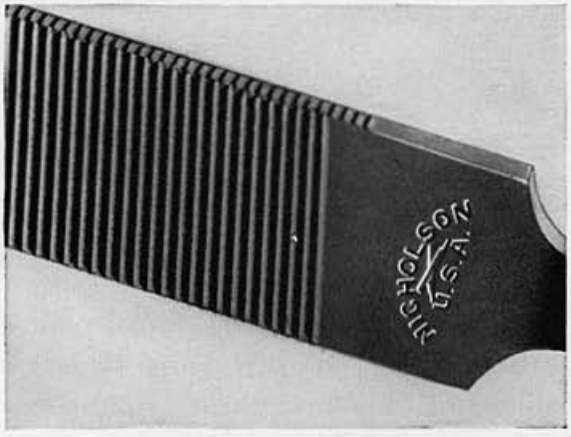
In addition to a short upcut angle, the Brass File (like the Aluminum "Type A") has a *fine,* long-angle overcut — producing small scallops which break up the filings and enable the file to clear itself of chips. With a little pressure, the sharp, high-cut teeth bite deep; with less pressure, their short upcut angle produces a smoothing effect. (Note the tooth construction, compared with regular Flat File.)



Brass Ordinary Flat

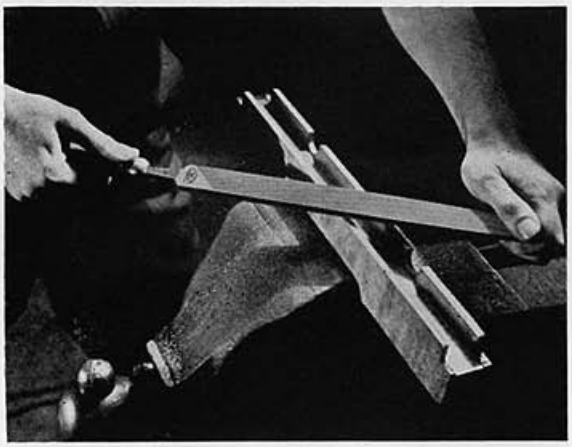
Filing Lead

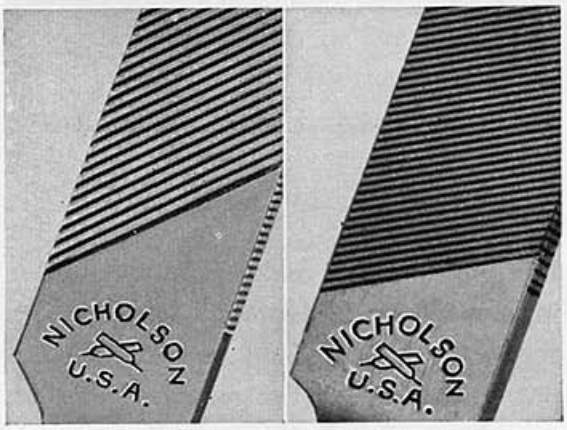
Extra-soft metals, such as lead, babbitt and pure copper, present filing conditions distinct from any others hereinbefore described. The metal removal in normal filing jobs is virtually a "shaving" or "floating" principle, as the design of this Lead Float File indicates. Its coarse, short-angle single-cut teeth are virtually a series of stubby "blades" which shear away the metal rapidly under ordinary pressure. Light pressure produces the smoothing effect.



Lead Float Files are used largely by plumbers and plumbing manufacturers, on lead pipe fitting, solder joints, etc.; and by machinists on soft bearings, shims and molded parts.

Smooth Finishing on Soft Metals





Shear Tooth Ordinary Mill

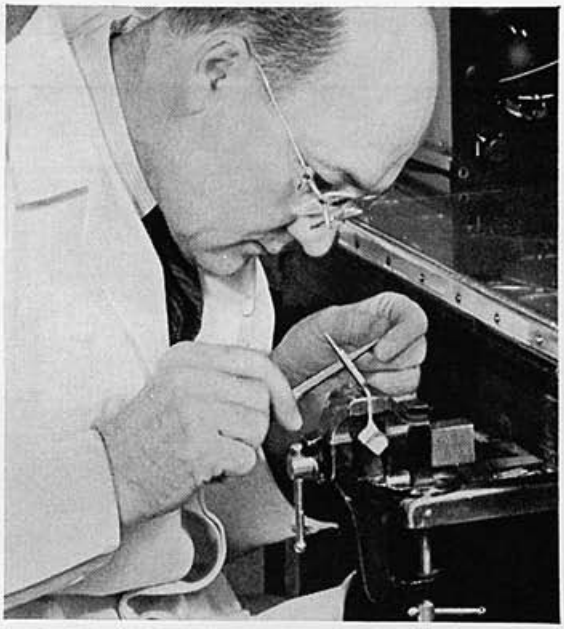
For some soft metals or alloys, such as aluminum, brass, copper — and even plastics, hard rubber and wood—there is a special file called the Shear Tooth which combines fast material removal with excellent smoothing qualities. The combination of the coarse single cut and the long angle helps the Shear Tooth File to clear itself of chips — minimizing clogging. Coarseness provides fast cutting; long angle gives the shearing cut, leaving a smooth finish.

Under certain conditions — as on narrow surfaces — the Shear Tooth has a tendency to run to the left because of its long angle (see comparison with regular Mill File). To overcome this it should be used with a somewhat diagonal stroke to the right.

Filing Plastics

Hard plastics are dense, brittle and relatively hard and the file removes the material in the form of a light powder. Because of the abrasive action of hard plastics, special files with high sharp teeth should be used. All the suitable types and sizes are available in Nicholson brand—including the curved tooth Super-Shear (see page 20) Users should specify "Files for Hard Plastics" when ordering.

Material from soft plastics is removed in shreds which tend to clog the teeth of standard files and files "For Hard Plastics." The Nicholson Shear Tooth File is recommended because its coarse single cut teeth, with an angle of 45°, file soft plastics with a minimum of clogging. Shear Tooth Files come in Flat and Half Round shapes.

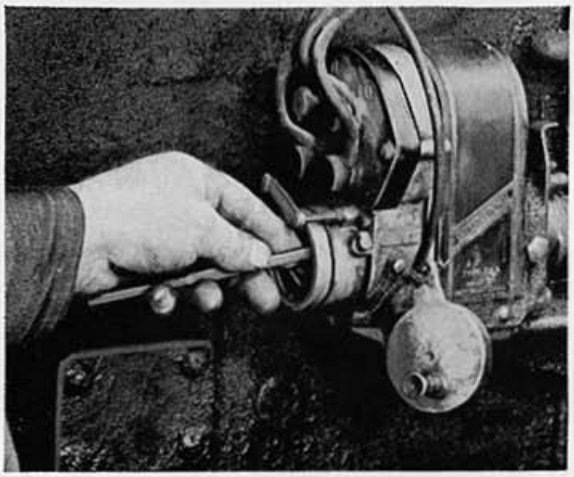


Precision Filing

Die and pattern making, model building, precision-instrument making and repairing have gained tremendous impetus in aircraft, automotive, engine, machine-tool and other rapidly expanding industries. Even the homecrafter and "gadgeteer" have become a "compelling" force in the nation's economic progress.

All these, to say nothing of the long-established clock, watch, jewelry and kindred industries, require precision files of innumerable shapes, sizes, cuts and purposes.

Following the original Swiss designs or patterns, America manufactures a very complete assortment of precision files called Swiss Pattern Files. While for many kinds of work regular files are all that are required, for the more particular purposes indicated above these Swiss Pattern Files, made to very exacting measurements and finer cuts, are necessary.



In precision filing, all the elementary instructions for general filing should be followed. The files should be kept separated from each other, in a rack or a case designed to that end, and should be cleaned frequently during their use.

The flat precision files should be used with a slow, smooth stroke, moving the file laterally along the work as the forward stroke is made. In using the round or half-round types, the file should be turned clockwise as the stroke is made, to assure a deeper cut and a smoother finish.

There are many instances — in model and fine-instrument making, for example — where intricate fit-filing is necessary on small forms of wood, plastics or other non-metallic materials. Swiss Pattern Files are perfectly adequate for such purpose, provided they are used while sharp and kept clean with a File Brush.

POINT OR COIL FILING *(left)*

This is a form of precision filing associated with "make-and-break" electrical circuits and particularly with the ignition systems of automobile and airplane engines. The files made for these purposes are usually described as Tungsten and Contact Files. The Tungsten File is generally used for dressing distributor points tipped with tungsten, iridium and similar metals. The Contact Point File is used on the contact or gap points of spark plugs, coils, magnetos, electric bells and switches. In dressing distributor points, especially, this type of file must be wielded with a perfectly straight ("non-rocking") stroke, in order that the broad surfaces of such contact points are filed perfectly flat — to engage each other effectively.

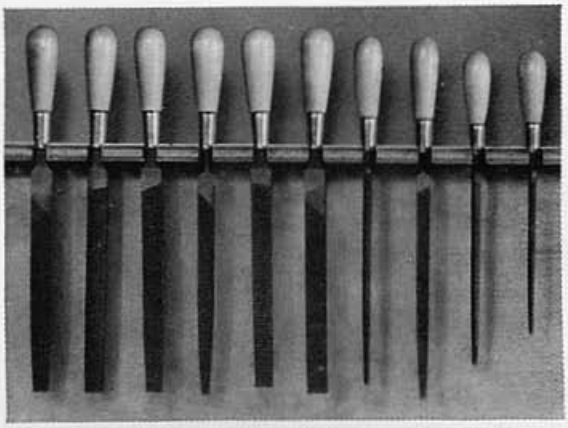


Fig. 4

The Care of Files

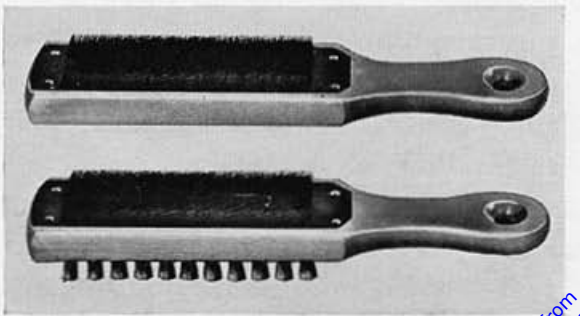
Fig. 5

File life is greatly shortened by improper care as well as by improper use—and improper selection. Files should never be thrown into a drawer or tool box containing other tools or objects. They should never be laid on top of or stacked against each other. Such treatment ruins the cutting edges of their teeth. Keep them separate—standing with their tangs in a row of holes or hung on a rack by their handles (Fig. 4) Keep them in a dry place so rust will not corrode their teeth points.

It is also of great importance to keep files clean of filings or "chips," which often collect between the teeth during use. After every few strokes the good mechanic taps the end of the file on the bench to loosen these "chips." And he always has on hand a File Card or Brush. The teeth of the file should be brushed frequently with this type of cleaner (Fig. 5)—and always before putting the file away To remove obstinate "pinnings" which sometimes clog up the teeth and cause scratches on the work, a "scorer"—made of soft iron—is often a further help. Oil or grease on file should be removed with chalk. A file kept clean lasts longer and does better work!

File Cleaners

File Cleaners are made in two styles: File Card *(top)* is for more general uses. File Brush *(bottom)*, combining Brush and Card, is used especially on the finer cut files. The over-all length of these Cleaners is 10".



In both range and technique, saw sharpening constitutes a broad filing field in itself. Saws are of many types. The files thus required must necessarily be of considerable variety too. Many of these have already been illustrated and technically described elsewhere in this book; and the more frequently used ones are again referred to in the discourse which follows.

SAW FILING, TOO, IS AN ART

Efficient saw filing demands, first of all, a steady hand and a good file. Not only that, the file must be *right for the job* — correct in design, cut and size for the kind of saw and the kind of teeth to be filed.

More definitely than on most other kinds of filing jobs, the filing stroke must be kept *level.* Even the slightest "rocking" motion has a tendency to affect the sharpness of the point and cutting edge of the saw-tooth. And, contrary to the action in ordinary bench filing, in saw filing the file is invariably lifted clear of the work when drawing it back for the next stroke.

Besides filing, another operation is required to make most saws cut efficiently This is to "set" the points of the teeth at the proper angle with relation to each other. This must be done *before* the filing is begun.

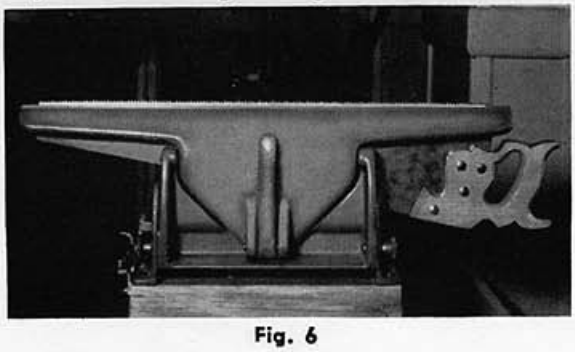


Fig. 6

In filing the teeth of most saws, some provision must be made for holding the blade properly The best equipment for this purpose is a saw vise (Fig. 6), which can be purchased in the hardware store. But lacking this, a satisfactory clamp may be made of wood. In fact, for the larger crosscut saws a clamp made of wood, with jaw edges curved to conform to the curvature of the saw's cutting edge, is widely used.

SHARPENING HANDSAWS — THE FIRST STEPS

Handsaws are of two types — crosscut and rip. Before sharpening, both these saws require resetting if they have been used for some length of time.

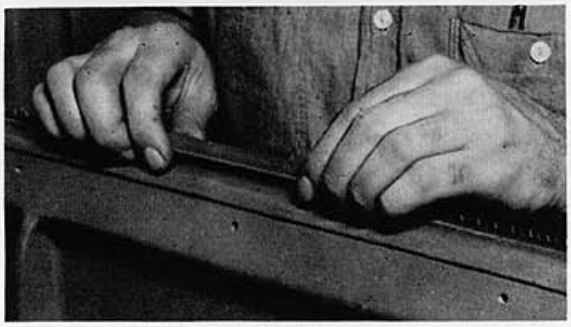


Fig. 7

In general, however, the saw may be sharpened with the file four or five times before resetting is required.

A preliminary step is to make sure that their tops are at an equal height. This is done by "jointing," or passing a file lightly lengthwise along the tops of the teeth (Fig. 7) After this is done, some of the teeth may have been flattened on top while others are barely touched. The teeth which have been flattened the most obviously require the most filing to put them into shape.

For the average user, the most satisfactory way of setting the saw is with

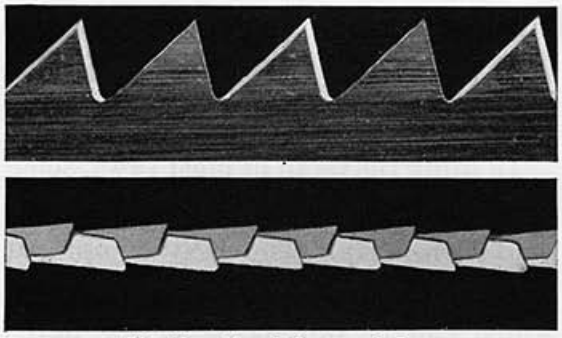


Fig. 8 — Hand Crosscut Saw

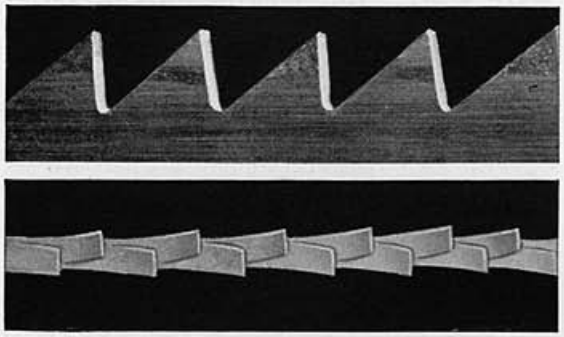


Fig. 9 — Hand Ripsaw

the use of the tool made expressly for the purpose — the Sawset. This tool is used to bend the teeth slightly — and *uniformly* — so that the width of the cut made by the saw will be wider than the blade itself (see Figs. 8 and 9) As shown in the illustration, alternate teeth are set in opposite directions on both the crosscut and the rip saws, to a distance of about half the thickness of the tooth; and the set should be done on the top half of the tooth only — for if too much of the tooth is bent, it may break off.

FILING THE HAND CROSSCUT SAW

The teeth of hand crosscut saws (Fig. 8) do their cutting with their edges and points, consequently these edges must be beveled accurately and sharp. This saw is clamped in the holder *with handle to the right,* and the filer should begin at the point of the saw and work toward the handle. For filing these saws, the following files are recommended:

For Saw Points per Inch

FIVE — 7" Regular Taper.
FIVE & ONE-HALF — 7" Regular Taper.
SIX — 7" or 8" Slim Taper.
SEVEN — 6" or 7" Slim Taper.
EIGHT — 6" Slim Taper, or 7" Extra Slim Taper or 8" Double Extra Slim Taper.
NINE — 6" Extra Slim Taper, or 7" Double Extra Slim Taper.
TEN — 5" or 6" Extra Slim Taper.

Place the file in the gullet to the left of the first tooth set away from you. Hold the file level with the angle of the saw blade, as indicated in Fig. 10. At this angle it should touch evenly on the bevels of the two teeth, so that both sides of the gullet are filed with the same stroke. *The file stroke must be kept level throughout the stroke.* If jointing the teeth has left some flat tops, such teeth at this time should be filed only until half the flat top is cut away Skip the next gullet and place the file at the same angle in the one following. Follow the same procedure until every other gullet has been filed.

Now reverse the saw and, beginning again at the point of the saw, place the file in the gullet to the right of the first tooth set away from you. (The saw is now held in the clamp so its *point* is toward the right.) File until the other

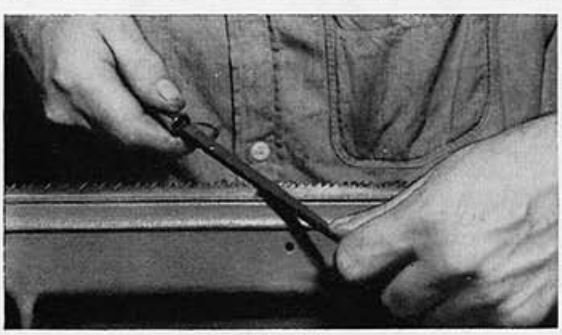


Fig. 10

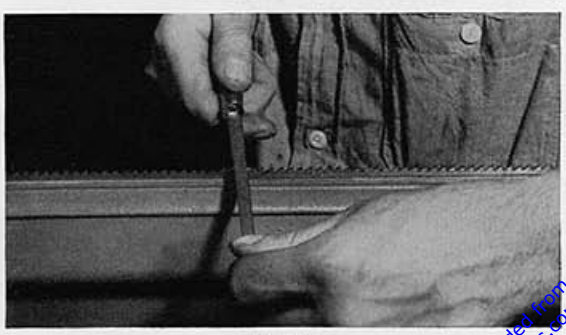


Fig. 11

half of the flat tops have been cut away, and continue, filing every other gullet, to the handle.

FILING THE HAND RIPSAW

So far as jointing the tooth points and the choice of file are concerned, the same procedure is followed in filing a hand ripsaw as in filing a hand crosscut. But it will be noted from the illustration (Fig. 9) that the ripsaw is filed so its tooth *points,* not its tooth edges, do the cutting. In this case the file is held level and at right angles to the side of the blade (Fig. 11) Every other ripsaw tooth is brought to a square edge; then the saw is removed and reversed, end for end, in the clamp, and the remaining teeth filed.

SHARPENING CROSSCUT SAWS

The common type of crosscut saw has two types of teeth, called "cutters" and "rakers." The cutter teeth actually do the cutting, while the raker teeth clear out the cut. The crosscut saw is best filed when it is held in the clamp at an angle of about 45° away from the filer, as illustrated in Fig. 12. This permits easier access to the cutter teeth and makes it possible to file them at the proper angle from a normal filing position.

The tops of the teeth of the crosscut saw should be jointed if they are not of uniform height, and the tops of the raker teeth should be below the tops of the cutter teeth — not less than 1/100 of an inch and not more than 1/64 of an inch — for normal work.

After the cutter teeth have been jointed, the filer takes a Special Crosscut Saw File, or a Mill File, and files all cutter teeth to a sharp point, as in Fig. 12. After the cutter teeth have been sharpened, the saw blade should

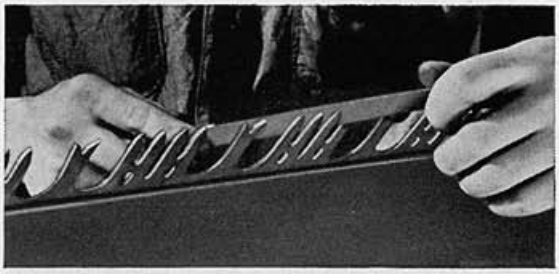


Fig. 12

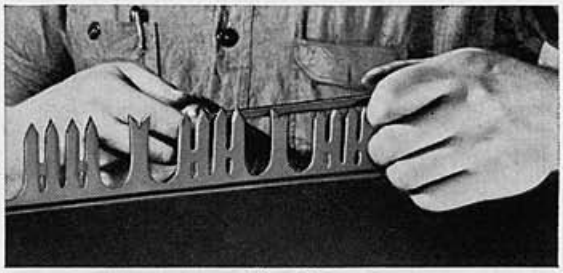


Fig. 13

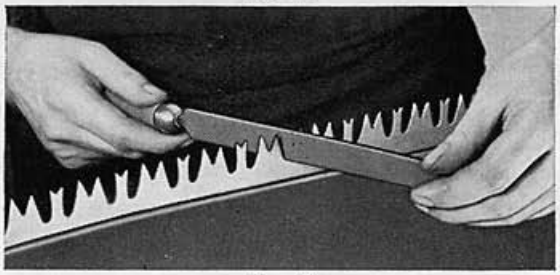


Fig. 14

be moved to the vertical position as in Fig. 13. The Special Crosscut Saw File or the Mill File may be used straight across on the rakers; or a Cantsaw File may be used to finish both edges of the raker tooth with the same stroke, as in Fig. 13.

In crosscuts in which the gullets of the teeth may require deepening, the saw filer should use a Round File, or a round-edge Mill. The latter makes it possible to deepen the gullet and file the tooth at one time with the same file (Fig. 14).

SHARPENING CIRCULAR SAWS

The circular saw is first jointed to make the points all exactly the same distance from the center. This may be done by holding a file on the saw table and turning the blade slowly backward by hand until the teeth all strike the file lightly and evenly Saws of large

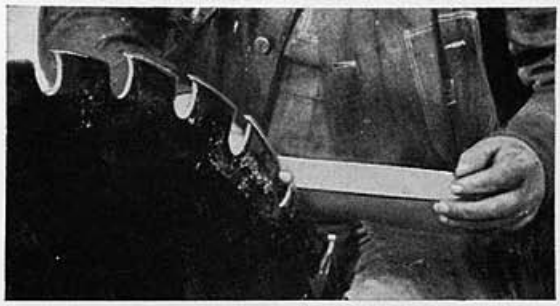


Fig. 15

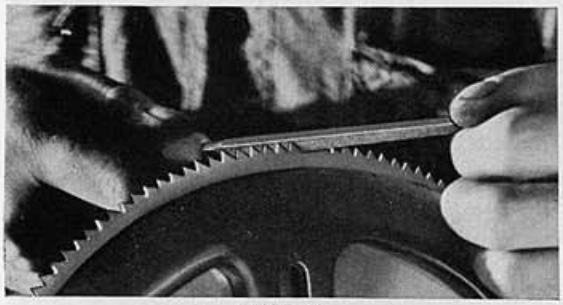


Fig. 16

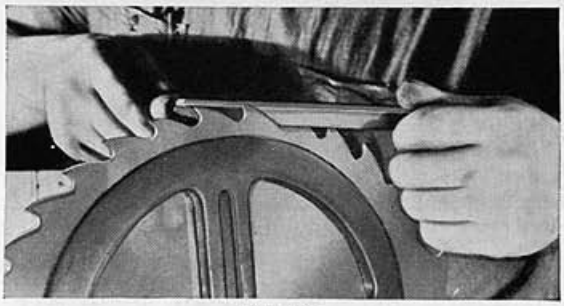


Fig. 17

diameter may be filed while in place if their blades are sufficiently rigid to prevent "chattering" (Fig. 15)

The best file for large circular saws is the 10" Cantsaw File, although the Mill Bastard File is often used.

Small circular saws should be removed from their arbors for filing, and may be held in a clamp in the same way as handsaws. A Slim Taper File will be found satisfactory for circular crosscut and circular combination saws (Fig. 16). The filer should use care to follow the outline of the original teeth in filing and to be sure that all teeth are the same shape, with gullets the same width and depth.

For filing the teeth of circular ripsaws, the Mill Bastard File with one round edge permits shaping gullets and teeth with the same file (Fig. 17)

FILING BUCKSAWS

The wood or bucksaw may be sharpened by removing the blade from the frame, placing it in a saw-filing clamp, and using a Slim Taper File—proceeding exactly as in filing the hand crosscut saw (see page 40). If the bucksaw must be sharpened while in use, it can be done without removing the saw from its frame (Fig. 18) A Mill Bastard File is used for touch-up work. One end of the frame of the saw is placed on a stump or other support with the teeth of the saw faced away from the filer. One hand holds the blade itself in the area to be filed, and the file is held in the other hand. The teeth are sharpened by stroking the file from the bottom to the top of each side of every tooth set away from the file. The frame is then reversed end for end, and the remaining teeth may be touched up. Each tooth is filed only until top is returned to a sharp point.

SHARPENING CHAIN SAWS

Chain saw teeth may be grouped into three general types, and almost all brands of chain saws use one of these types or a variation of them. A different kind of file is used to sharpen each type of chain saw tooth. It is not considered to be good practice to sharpen chain saw teeth on the saw bar because they are not supported rigidly and the filings will shorten chain and bar life if allowed to circulate in the mechanism during operation. Each chain saw manufacturer can supply a vise designed to hold his particular chain.

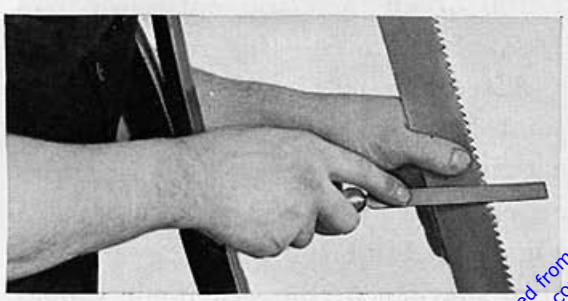


Fig. 18

Round-hooded Chain Saw Teeth require Round Chain Saw Files which are specially designed for this use. These files are made in various diameters to fit all sizes of round-hooded chain saw teeth. The saw teeth face to both sides

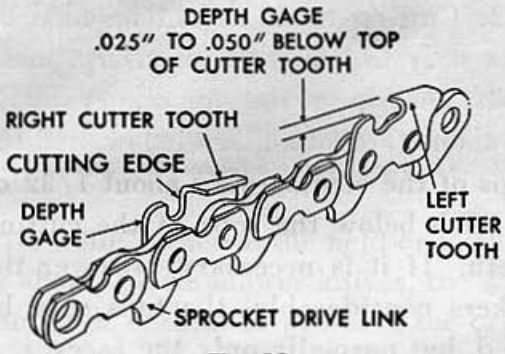


Fig. 19

and provide their own clearance; no setting is necessary The file is placed against the beveled cutting surface of the tooth at an angle of 25° to 45° with the saw blade. The direction of the filing stroke is off the cutting edge. It is essential that the file be held level and it should be pressed back and slightly up during the filing stroke. Every other tooth is filed, and then the saw is reversed to complete the job. The depth gages of this type of saw (Fig. 19) control the depth of cut that the saw will take. As the cutting teeth are sharpened they become lower, and it

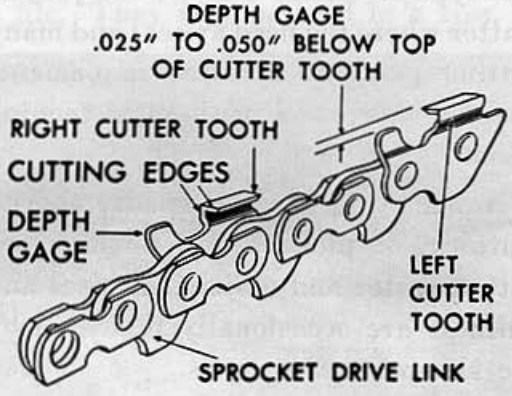


Fig. 20

is necessary to lower the depth gages an equal extent. The difference in height between cutting teeth and depth gage should be between .025 and .050 of an inch. The choice within this range depends on the design of the teeth and the hardness of the wood being cut. On harder woods a small clearance is used and on soft woods a larger clearance is best. This can be measured by placing a file on top of two cutting teeth and using a feeler gage between the enclosed depth gage and file. Some chain saw manufacturers provide a special tool for this use. If the depth gage is too high, it should be filed down with a Mill File, making certain that the forward edge is rounded to prevent gouging and a rough-running chain.

Square-hooded Chain Saw Teeth are sharpened with either a Lozenge Chain Saw File or a Square Chain Saw File. The Lozenge shape is usually

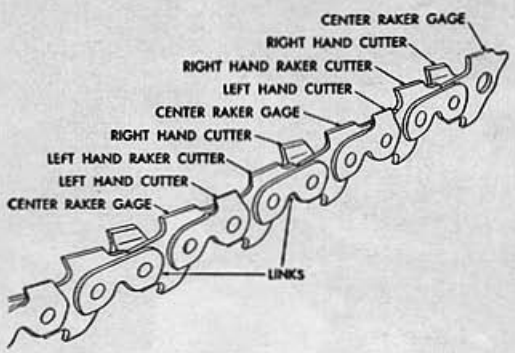


Fig. 21

preferred, for it is easier to maintain the angles of the saw teeth with this file. The chain has right- and left-hand cutters (Fig. 20) which provide their own clearance, so no setting is necessary Each tooth has two cutting surfaces which intersect at approximately 90° The direction of the filing stroke should be off the cutting edge. The file is placed under the hood so that two adjacent sides of the file contact both of the saw tooth cutting edges at one time.

The axis of the file must be tilted down and back, and during filing the direction of the stroke should be in a straight line. It is important to maintain the original shape of the teeth. These teeth have depth gages similar to the round-hooded type, and should be sharpened in a similar manner.

Cutter-Raker Chain Saw Teeth. The arrangement of the teeth on these saws varies considerably, but they all have a combination of cutter teeth and raker teeth. The cutter teeth are on the outside, and the uppermost part is a sharp point (Fig. 21) They are already set. There are three types of rakers in the chain depicted here—a left, center and right raker. A Flat Chain Saw File with round edges is recommended for the cutter-raker type of chain saw Here are the important sharpening hints:

1. Jointing is necessary if the chain is badly worn.
2. Cutting teeth should be filed on face only to bring up the sharp point.
3. The tops of the side rakers should be about 1/64 of an inch below, and the tops of the center raker about 1/32 of an inch below the tops of the cutting teeth. If it is necessary to lower the rakers considerably, the tops may be filed, but normally only the faces.
4. In all cases the original angles of the teeth should be maintained.

Sharpening Tools and Implements

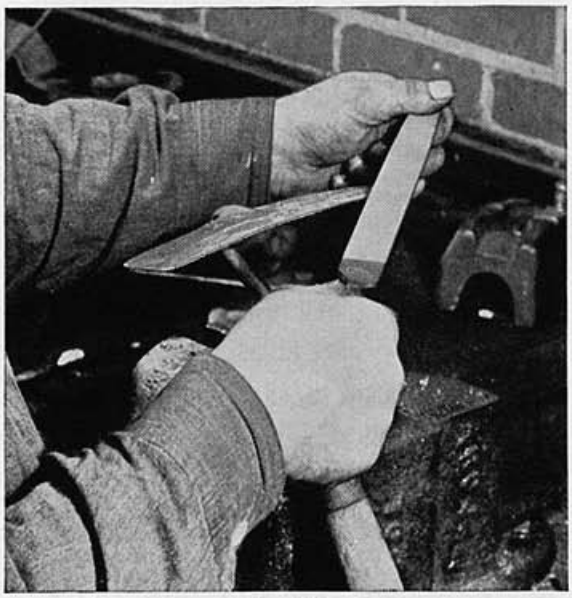


Fig. 22

In a wide range of every-day tools and implements, files are being used increasingly for sharpening jobs which commonly have been done by other methods.

This is due largely to the high efficiency of today's files in general, and to the fact that files are comparatively inexpensive, readily obtainable and *very convenient* to use. You can take this type of "sharpener" *to* the job, no matter where the need arises; and many cutting parts of machine implements can be sharpened without detaching them.

A hoe (Fig. 22), a spade, shovel, mattock, or pickaxe will do its work better, faster and easier if bruises and dullness are occasionally remedied by file sharpening.

Similarly, mowing machine knives (Fig. 23), silage cutters, pruning shears, hedge clippers, scythe and sickle blades may be quickly "touched up

Fig. 23

with a file, either in the field or in shed or shop. (With mower knives, the filer should be careful to preserve the original bevel. The knife guards of mower or harvester should also be filed occasionally to keep their points sharp—to prevent them from "seizing" while in use.) Plowshares, seed-drill and cultivator shovels, harrow spring-teeth and discs also contribute to faster production, saving time, earning dollars when "whipped" into faster working action by the unsparing use of the faithful file. (When severely dulled or bruised, they should, naturally, be removed, heated and beaten on an anvil; then edge-finished with a coarse file and rehardened.)

Woodsmen and carpenters frequently sharpen axes, hatchets and adzes with a file. They may be held in a vise, or

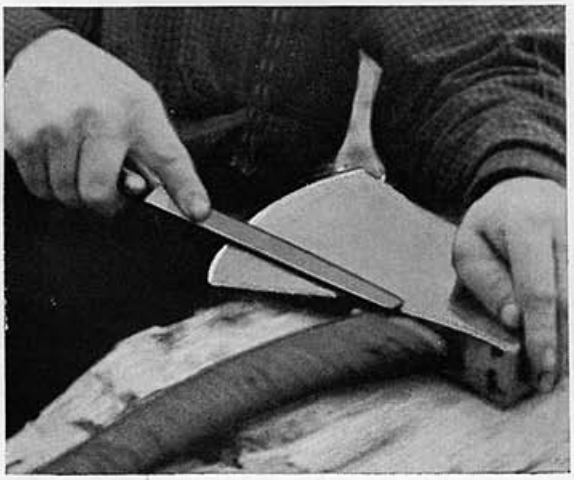


Fig. 24

laid on a bench or block and held down firmly with one hand (Fig. 24) while being filed with the other. Such tools may be filed either "toward" or "away" from the edge—the former usually for the early part of the job, the latter for the light "finishing touches."

For auger bit sharpening (Fig. 25), there are specially designed Auger Bit Files. These files are of double-ended tapered design which permits a narrow

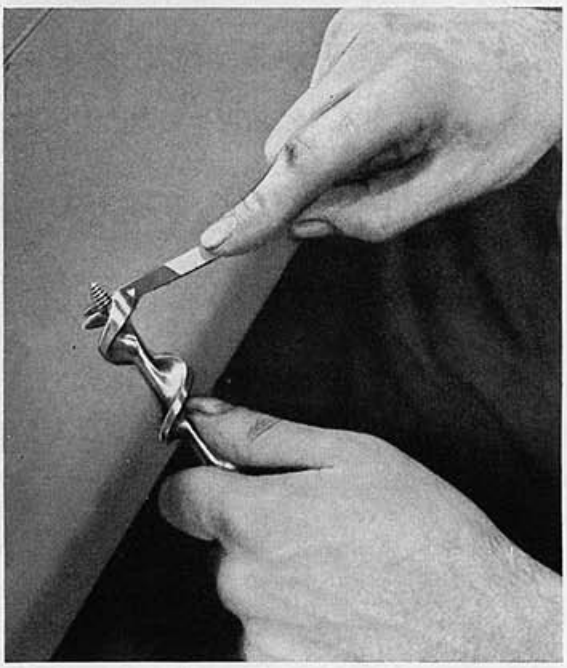


Fig. 25

file section to be used on the edges of small-diameter bits, and wider sections on the larger bits. One end of this type of file has its *edges* left "safe" or uncut; the other has its *sides* left safe. Thus the sides may be used on bit cutters, or the edge on the lip of the bit, without causing damage to adjacent surfaces.

In sharpening bit cutters, it is necessary only to follow the original bevel, removing sufficient metal to take any bruises out of the edge. This filing is done only on the spiral flute side of the bit's cutting edge. The spurs or nibs are filed on inside edge. The bit may

be held in a vise, or firmly held with one hand at a convenient angle against the edge of the work-bench.

Knives, shears and similar cutting utensils used in the home, shop or mill comprise a vast further sharpening field for files.

For coarse-steel cutting edges—like those of hoes, plows, etc.—the Mill Bastard File is popular and generally most practical. For the harder, high-carbon steels in cutter knives, shears,

Fig. 26

etc., the Second Cut or Smooth Mill provides the sure but smoother bite needed for a fine, keen cutting edge.

RASPS AND THEIR USES

In general, the Rasp bears the same relation to other wood-working tools as the file bears to other metal-working ones. Rasps are broadly classed as Wood, Cabinet and Horse. Variations of these are Shoe, Pattern Makers, Last Makers.

The Wood Rasp is of coarser cut than the Cabinet Rasp. It is made primarily for rapid stock removal. Made in the flat, half round and round shapes, it is used for rounding wood stock, like farm wagon tongues, single-trees, axe and other wooden tool handles.

For finer woodwork, the Cabinet Rasp provides the means for bringing mortise-and-tenon joints to proper fit, making end-grain cuts, and handling similar jobs where stock is to be removed and a fairly smooth finish attained (Fig. 26).

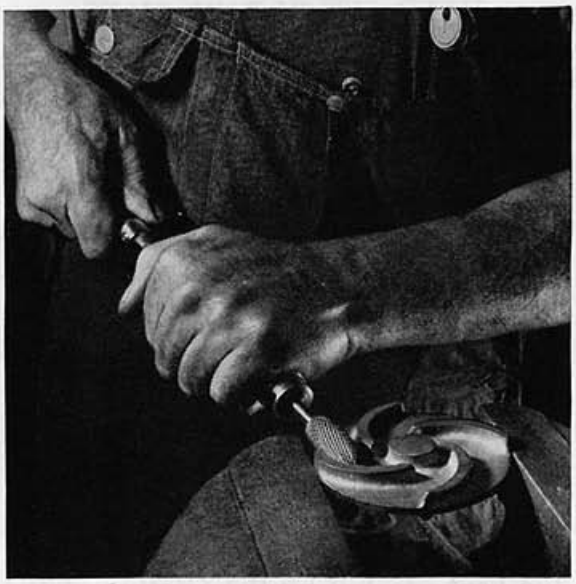
Horse Rasps. Their design and tooth construction make them widely popular for cutting down and shaping hoofs for horseshoeing (Fig. 27). They have rasp teeth on one side and file teeth on the other; and the most frequently used type is the double ender—which provides the forward action from either end.

Rasps too badly worn for their original purpose are usually made use of by farmers and blacksmiths in "hot metal filing." When a horseshoe or other piece of metal is to be brought to a rough shape quickly, it is heated in the forge and at red or white heat is easily cut with the Rasp (Fig. 28)

Plumbers, too, use Rasps—for filing lead pipe and roughing down solder joints. (Various commonly used Rasps are illustrated and described elsewhere in this book.)

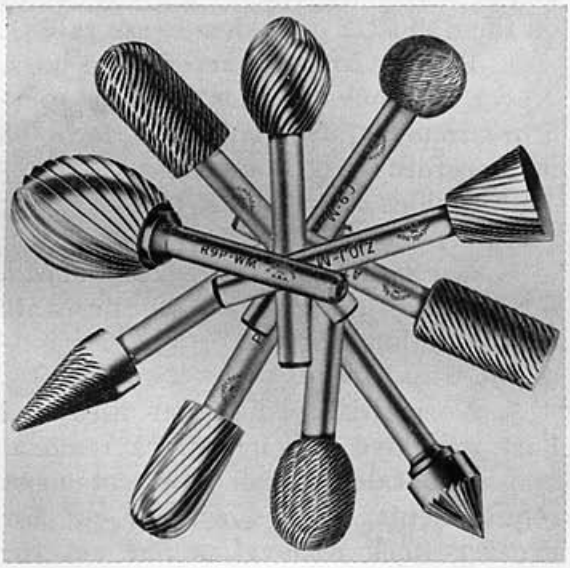
Fig. 27

Fig. 28



Rotary Files and Burs

The tremendous growth of portable electric and pneumatic power tools has developed a widespread use for rotating-type files and burs. They are also operated in lathes and drill presses and through variously driven flexible shafts. This versatility in application, plus their wide range of head shapes and sizes, makes them available on thousands of jobs—in machine, tool, metal pattern and die sinking shops; in automobile, airplane and hundreds of other factories; in the repair fields, the plumbing, building and other trades, and widely among home craftsmen.



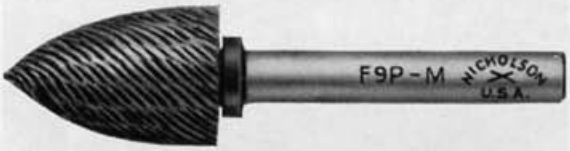
Rotary Files and Rotary Burs (which have fluted cutting edges—usually in spiral form) are generally made from high-speed steel. Rotary Burs are also made of carbide and, though more brittle, these have up to *one hundred times* the serviceable cutting life of high-speed steel. They are used mostly on long production runs and require extra-skillful operating.

Cutting heads, in both File and Bur types, are of many shapes. Cylindrical (with both flat and radius ends), Ball, Barrel, Oval, Tree, Flame, Cone, Inverted Cone, Concave, in various angles, tapers or arcs, are the most common. Head diameters vary from $\frac{1}{8}''$ to $1\frac{1}{4}''$; and shanks are usually of $\frac{1}{4}''$ and $\frac{1}{8}''$ diameters.

For highest efficiency and longest life, Rotary Files and Burs should be operated at designated speeds based on their head diameters and the type of metal being worked—like mild steel, cast iron, bronze, aluminum, magnesium, etc. The manufacturer's speed table and rules of usage should be closely observed.

HAND CUT ROTARY FILES

As their name indicates, Hand Cut Rotary Files are cut by an expert hand-cutter, using a hammer and chisel to form each tooth. Because the teeth are "broken up," in contrast with the "unbroken flutes" of the Ground Bur, they are better fitted for work on dense

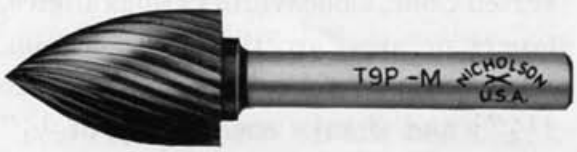


Rotary File *(Tree Shape Pointed End)*

metals. These teeth tend to dissipate the heat created by the friction of the file on this type of material. Therefore, they are recommended for tough die steels, steel forgings, electric and gas welds, or any scaly or tough surface of metal.

GROUND BURS

Ground Burs are cut from solid blanks with a machine-driven grinding wheel producing a series of unbroken basic flutes extending the full length of the cutting head from the base to the nose; and in the case of round, oval and pointed-oval heads, with intermediate flutes cutting into the basic flutes at appropriate places. (Some Ground Burs are made with "alternate fluting," which means that every other flute extends to the extreme point of the head.)



Ground Bur *(Tree Shape Pointed End)*

Under the Nicholson method, a master bur guides the grinding wheel, thus assuring absolute uniformity in type and size bur, no matter how many of each are produced. This precision measure assures accuracy of shape and even tooth height around the periphery, thus eliminating jumping, vibration and uneven wear.

In general, Ground Burs are more efficient than Hand Cut Rotary Files on non-ferrous metals such as aluminum, brass, bronze and magnesium. Because of the ductility of such metals, Ground Burs are ideal cutting tools since their fluted teeth readily free themselves of troublesome chips.

USING HIGH-SPEED STEEL ROTARY FILES AND BURS

The following principles should help the user toward the best results:

1 Move the file or bur at an even rate of pressure to avoid the "hills and

dales" that will show up if an unsteady pressure is applied.

2. The speed at which the file or bur can be driven depends to a great extent on the diameter of its head (see table)

3. Be sure to use sharp files or burs. Never overlook the fact that the operator's time is the big cost item, and that he therefore needs sharp tools. (Nicholson provides an excellent resharpening service.)

4. Use a short grip on the shank of a flexible shaft or power tool for accurate control; a longer grip for reaching out-of-the-way places.

5. Normally, medium-cut files and burs will give sufficient stock removal and acceptable finish to meet most requirements. Use a coarser cut for greater stock removal, a fine cut for extra-smooth finish.

Approximate Speeds (R.P.M.) in Medium Cut

Head Diam.	Mild Steel	Cast Iron	Bronze	Alumi-num	Magne-sium
1/8"	4600	7000	15000	20000	30000
1/4"	3450	5250	11250	15000	22500
3/8"	2750	4200	9000	12000	18000
1/2"	2300	3500	7500	10000	15000
5/8"	2000	3100	6650	8900	13350
3/4"	1900	2900	6200	8300	12400
7/8"	1700	2600	5600	7500	11250
1"	1600	2400	5150	6850	10300
1 1/8"	1500	2300	4850	6500	9750
1 1/4"	1400	2100	4500	6000	9000

CARBIDE BURS

This recent development among modern cutting tools has tremendous possibilities for reducing burring costs—particularly on long production runs. Though it costs about fifteen times more than its equivalent in high-speed steel, the Carbide Bur has been demonstrated to last *up to one hundred times as long*—an advantage ratio of about five to one.

Carbide Bur *(Tree Shape Pointed End)*

Carbide Burs are made with flutings, rake and coarsenesses somewhat changed from their prototypes in high-speed steel Hand Cut Rotary Files and Ground Burs. They may be used on hard or soft materials with equally good results. They come in variations of Cylindrical, Oval, Ball, Tree and Cone shapes; in 1/4" and 1/8" shanks; in Medium and Fine cuts; in Coarse on special order. Also made in Diamond cut (like a double cut file) for use on tough die steels.

Recommended Speeds in Medium Cut

Head Diam.	R.P.M.	Head Diam.	R.P.M.
1/8"	45000	5/8"	18000
1/4"	30000	3/4"	16000
3/8"	24000	7/8"	14500
1/2"	20000	1"	13000

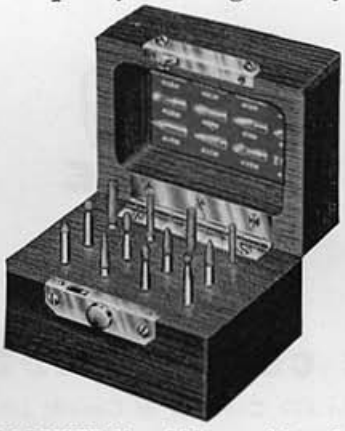
In Fine Cut, decrease speeds about one-third.

Don't do this

USE THEM WITH CARE

These Carbide Burs have the highest Rockwell hardness consistent with necessary toughness. They are nevertheless relatively brittle and must be treated with more discretion than ordinary burs. Under no circumstances must they be tossed onto a bench or among other tools where their cutting edges may become damaged.

ROTAKIT No. 40 consists of 5 Nicholson Hi-Speed Steel Burs and 5 Hi-Speed Steel Rotary Files with 1/4" shank. Other assortments available.



CARBISET No. 100 consists of 12 assorted 1/8" shank Nicholson Carbide Burs encased in handsome mahogany box. Also available as individual items or in smaller assortments.

ROTASET No. 88 consists of 18 Nicholson Hi-Speed Steel Burs in assorted shapes and with 1/8" shank. Also available in Rotary Files, and in combinations of Burs and Files.

Nicholson File Company Files and Rasps are marketed under the following brands:

NICHOLSON U.S.A.

BLACK DIAMOND MADE IN U.S.A.

AMERICAN TRADE MARK

ARCADE TRADE MARK

GT. WESTERN TRADE MARK

McCLELLAN TRADE MARK

K&F TRADE MARK

TRADE MARK GLOBE

J.B.SMITH,U.S.A. TRADE MARK

TRADE X.F. MARK (SWISS PATTERN)

Superior

EAGLE U.S.A. TRADE MARK

TRADE BEAVER MARK

NICHOLSON FILE CO., PROVIDENCE, R. I., U. S. A.

(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

PRINTED IN U. S. A.

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